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A Revision of the Bees of the Genus Melissodes in North and Central America. Part I. (Hymenoptera, Apidae)[1]

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ABSTRACT: This paper is the first part of a monographic revision of the bee genus *Melissodes* in North and Central America. Although primarily a taxonomic study, this work brings together available data concerning phylogeny, distribution, biologies of several species and flower preferences.

Ten subgenera are recognized, including the following newly described: *Brachymelissodes, Idiomelissodes, Apomelissodes, Eumelissodes, Heliomelissodes, Psilomelissodes, Tachymelissodes.* This paper deals with 39 species, ten of which are polytypic, so that 53 species or subspecies are recognized. A total of 29 names is relegated to synonymy and 13 species are moved to other genera. About 15,500 specimens were examined.

Ten new species are described: *M. minima, M. aegis, M. nitida, M. sila, M. blanda, M. cubensis, M. elusa, M. flexa, M. maesta* and *M. tessellata.* Seven new subspecies are named: *M. atripes atrimitra, M. sabinensis nubila, M. texana eluta, M. bimaculata nulla, M. gilensis crenata, M. tepida yumensis* and *M. thelypodii stulta.*

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INTRODUCTION

This paper is the first part of a systematic revision of the eucerine bees of the genus *Melissodes* Latreille occurring in North and Central America. An attempt has been made to elucidate the phylogeny of the group. This has led to the conclusion that the genus, as presented here, is probably polyphyletic. However, the recognition as separate genera of certain phyletic lines included in this genus has not been attempted in this work, but has been left to a proposed generic revision of the tribe Eucerini which is now in progress.

In the region covered by this revision, the genus includes more than 100 species, many of which are polytypic. Ten subgenera are recognized and described and the species of five of these subgenera are described in full in this part of the revision, while the species of the remaining subgenera will be dealt with in future parts of the revision. The present work includes a total of 39 species; ten of these have two or three subspecies each, so that 53 forms are described.

A paper by Cockerell (1906) is the only extensive treatment of the genus and consists mainly of keys to most of the known species occurring in North America. The species are almost impossible to recognize by using Cockerell's keys. He lacked access to the types of species described by Charles Robertson and most of these were omitted from the keys. Cockerell used color characters almost exclusively and, although the color pattern remains important in the present work, he did not recognize the great variability of certain of these characters. Also, many species were unrecognized at the time Cockerell's key was published. The only other papers published concerning the genus are descriptions of new forms, brief biological notes, lists of species and short works on the faunas of limited areas.

The genus *Melissodes* was proposed by Latreille (1829) to include the American eucerine bees having only four segments in the maxillary palpi and having three submarginal cells. Latreille

included no species in this genus. Romand (1841) described *Melissodes fonscolombei* from a female from Chile and a male from the West Indies. For reasons discussed fully by Lutz and Cockerell (1920), and by the present author in a note which has been sent to the Secretary of the International Commission on Zoological Nomenclature for publication in the Bulletin of Zoological Nomenclature, *M. fonscolombei* Romand should be considered as a *nomen dubium*. *Melissodes leprieuri* Blanchard, 1849, is then the first included species and the type species of the genus.

Because the genus as currently recognized is probably polyphyletic and because there are many parallelisms within the tribe Eucerini in the Western Hemisphere (parallelisms which are not completely understood at present), a detailed description of the genus is not attempted at this time. A generic revision of the tribe is now in progress and it is hoped that a description of this genus can be presented in the near future. The four-segmented maxillary palpi separate the genus from other North and Central American genera except that in the subgenus *Apomelissodes* there is a single species with three-segmented palpi and in the subgenera *Melissodes* and *Epimelissodes* there are occasionally individuals, especially males, with five-segmented palpi.

A few characters common to all or most of the species of the genus, and to some other eucerine genera, are as follows: the malar space of both sexes is always absent or extremely short; the propodeum of both sexes has a distinct dorsal face, never being completely declivous; the scopal hairs of the female have at least one or two branches on each side (except in the one species of *Apomelissodes* having three-segmented maxillary palpi); the last exposed sternum of the male is flat or shallowly grooved medially, not with a large median protuberance or large flanges on each side; the gonostyli of the male are straight or slightly curved and never distinctly elbowed; the eighth sternum of the male is testaceous, never wholly piceous; the last flagellar segment of the male is rounded or truncate apically, never attenuate.

Several species of *Melissodes* are of widespread occurrence in North America and are of some importance in the pollination of such agricultural crops as alfalfa and cotton. The genus as a whole, because of the great number of species and because of the abundance of a number of these, must play an important role in pollination of many plants in nature.

DISTRIBUTION AND PHYLOGENY

The North American subgenera can be placed in two groups which probably represent two phyletic lines. The subgenera *Epimelissodes, Brachymelissodes* and *Idiomelissodes* constitute group 1 and the remaining subgenera (*Melissodes, Ecplectica, Eumelissodes, Heliomelissodes, Apomelissodes, Psilomelissodes* and *Tachymelissodes*) make up group 2.

In the first group the dorsal carina of the gonocoxite of the male genital capsule is drawn out into a blunt process directed more or less medially. The median plates of the seventh sternum of the male are small, undeveloped lobes. The male antennae are usually short or moderately long (long in *Idiomelissodes*). Both sexes usually have spatuloplumose hairs at least between the mesoscutum and the scutellum and in the basal pubescent band of the second tergum (lacking in *Brachymelissodes*). The metanotum usually has a distinct, low, densely punctate, median eminence bearing relatively long hairs, in contrast to the relatively flat, sparsely punctate, short-haired, lateral areas (not well developed in *Brachymelissodes*). The tegulae of both sexes are broadly rounded anteriorly, not narrowed and flattened in the anterior halves. The subgenus *Idiomelissodes* has, in addition, greatly enlarged penis valves and small gonostyli in the male, hooked tibial spurs and certain other peculiarities described below which may result in its eventually being considered as a distinct, monotypic genus.

Species of group 2 have the tegulae narrowed and flattened anteriorly with the result that the lateral border of each tegula is concave or straight rather than convex in the anterior half. A single species (in the subgenus *Tachymelissodes*) is exceptional in this regard in that the tegulae are gently convex anteriorly, although still somewhat narrowed and flattened. In general, group 2 is characterized by lacking the structural peculiarities described above for group 1, and in having the median plates of the seventh male sternum enlarged or modified in various fashions.

Group 1, as far as is now known, has no representatives in South America. Moure (1944) believed that he had a species of *Epimelissodes* from Brazil, but the three-segmented maxillary palpi and certain other features clearly relate this species to the genus *Ptilomelissa* which is not closely related to *Epimelissodes,* so far as is known at present. *Svastra* Holmberg of South America is related to *Epimelissodes* and, perhaps, should be included in the phyletic line described above as group 1.

Both group 1 and group 2 seem not to occur in Europe, and probably arose independently in the Western Hemisphere, possibly in South America. The subgenera occurring in North America may have arisen from representatives of both groups which reached the Mexican plateau area. Both groups range as far north as extreme southern Canada, but are rare (group 1) or poorly represented (group 2) in Canada.

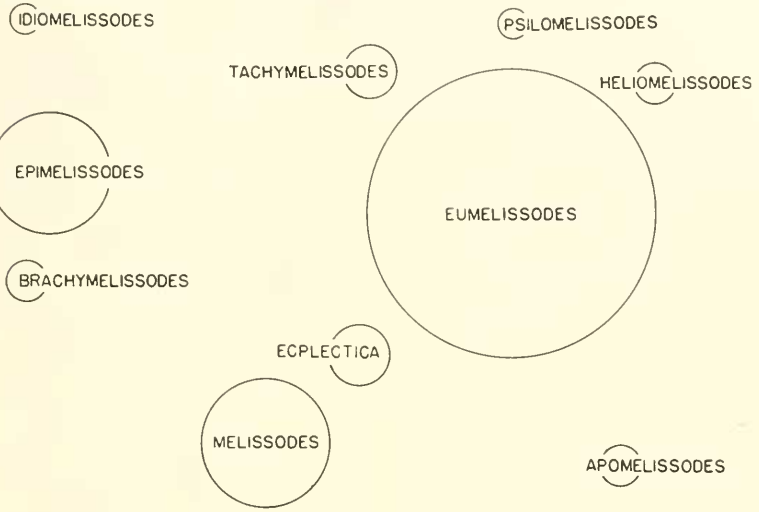

Fig. 1. Diagrammatic representation of the relationships of the subgenera of *Melissodes* Latreille. The area of each circle indicates the approximate number of species in each subgenus, *Psilomelissodes* being unity. The distances between the perimeters of adjacent circles represent degree of relationship. The subgenera *Epimelissodes*, *Idiomelissodes* and *Brachymelissodes* form a distinct group and are not closely related to any one of the remaining subgenera.

The genus *Florilegus* Robertson (not treated in this report) apparently is related to both of these groups and bears the primitive character of five-segmented maxillary palpi. The subgenus *Ecplectica* of group 2 of the genus *Melissodes* resembles *Florilegus* in external appearance. Both *Florilegus* and *Ecplectica* are abundant and diversified in South America and have a few representatives in Central America and the West Indies, while *Florilegus* has one species entering southeastern United States. The other subgenera of group 2 do not enter South America, so far as is now known, but two of the subgenera (*Melissodes* and *Eumelissodes*) are distributed as far south as Panamá and the Leeward Islands in the West Indies. Both of these subgenera are probably derivatives of

Ecplectica, as indicated by the form of the seventh sternum of the male and certain other characters, while the remaining subgenera of group 2 are specialized derivatives of the subgenus *Eumelissodes* and are restricted to North America. Figure 1 presents schematically the relationships outlined above.

Parallelisms existing between certain of these ten subgenera are striking. *Brachymelissodes* of group 1 parallels *Tachymelissodes* of group 2 in the following respects: apical pubescent bands on the metasomal terga; extremely short male antennae; relatively long first flagellar segments of the male antennae. In this case there is no apparent environmental reason for the parallel characters. Neither subgenus is particularly oligolectic and they do not have similar distributions.

Heliomelissodes and *Apomelissodes* of group 2 each have a protruding clypeus in both sexes. This is apparently a parallel adaptation to certain flowers. Each group consists of a few species which are oligolectic on flowers which require relatively long mouthparts to reach the nectar sources. The protruding clypeus is evidently an adaptation to contain the longer mouthparts when these are folded and not in use. This character reaches an extreme (for this genus) in *M. (Apomelissodes) fimbriata* which seemingly is restricted to plants of the genus *Oenothera.* In addition, *Apomelissodes* parallels *Brachymelissodes* and *Tachymelissodes* in having apical tergal bands of pubescence, again with no apparent reason.

Psilomelissodes has unusually short male antennae and long first flagellar segments similar to *Brachymelissodes* and *Tachymelissodes.* Groups in which the male antennae are moderately long, such as *Epimelissodes* and *Heliomelissodes* (also several species of *Eumelissodes*) have moderately long first flagellar segments as well, whereas species with long antennae have the first flagellar segments extremely short. This negative correlation, which is followed rather rigidly even within each subgenus, suggests that there is probably a functional relationship between the length of the antennae and the length of the first flagellar segments.

GEOGRAPHICAL VARIATION

Several of the species described below are widespread and polytypic, each consisting of two or three subspecies. These subspecies differ in the color pattern of the pubescence and in a few cases by minor differences in punctation. The subspecies are discussed in some detail under each species in a section on geographical variation.

On the basis of the distribution of the polytypic species of *Melissodes* an ecological rule could be established that the paler forms occur in the west and southwest and the darker forms in the east in North America. Additional support for such a rule comes from certain largely allopatric pairs of closely related species (especially in the subgenus *Epimelissodes*). Within each of these pairs of species (*M. machaerantherae* and *M. comanche, M. helianthelli* and *M. grandissima, M. grandissima* and *M. aegis*), the palest occurs west of the darkest species.

However, the situation in three of the polytypic species (and in certain species of the subgenus *Eumelissodes* which have not been critically studied as yet) suggests a different explanation. *M. thelypodii* and *M. gilensis* each consist of two subspecies which are distributed with the paler subspecies north of the darker subspecies. In these species the darker subspecies occur in middle and southern Mexico in somewhat moister climates than the paler subspecies to the north. *M. tepida* is composed of three subspecies in which the darkest is distributed from central California north to Oregon, the palest occurs in the intermontane region north to western Oregon and the third subspecies occurs south of the other two and is dark in some respects and pale in others. These facts, together with the east-west distribution of the species and subspecies described above, suggest that the ecological rule should be that the pale forms (subspecies or closely related species) occur in areas with drier climates than the darker related forms.

In many fossorial Hymenoptera, particularly bees, the prepupae and pupae are present during the dry seasons in the southwest. The adults appear shortly before or during the rainy season and the larvae often complete their development quickly while the earth is still moist. If such is true of *Melissodes*—and at least the seasonal appearance of the adults is usually correlated with such a cycle—the precipitation or moisture conditions are probably operative in selection during the prepupal (or pupal) stage.

M. (*Epimelissodes*) *atripes* presents an interesting exception to this rule. This species is divisible into three subspecies, two of which follow the rule, while the third occurs in eastern Florida and Georgia in contact with and intergrading with the darkest subspecies to the north and west, but is the palest of the three subspecies. This Florida subspecies (*M. atripes georgica*) perhaps can be explained by additional selective factors, such as an adaptation to the white coralline sands so abundant in eastern Florida.

M. (*Melissodes*) *tepida* presents a similar sort of situation. As

explained above, one of the three subspecies occurs to the south of the others. This subspecies (*yumensis*) occurs in a region drier than the other two, but is not paler. It is thought to have originated while isolated from the other two subspecies and this isolation could have allowed selective factors to operate which are unrecognizable at the present time.

The correlation of melanism with humidity which occurs in these bees may be a result of selection by vertebrate (birds) or insect (Asilidae) predators, rather than a direct effect of the environment. The pale subspecies of *M. atripes* in Florida mentioned above seems to support such an hypothesis. However, a great deal remains to be learned concerning the biology of these bees and, especially, concerning their parasites and predators.

An ecological rule similar to the rule described above has been applied to warm-blooded vertebrates and is known as Gloger's rule. Temperature, as well as humidity, is correlated with the distribution of melanism in warm-blooded vertebrates according to Gloger's rule, and in this way the latter differs from the ecological rule here applied to the distribution of *Melissodes.*

A similar correlation has been described in several insect groups: in the Vespid genus *Polistes* by Zimmermann (1931), in the Bembidiine wasps by Netolitsky (1931), in the Sphecine wasps by Fernald (1926), in Coccinellid beetles by Dobzhansky (1933) and for California butterflies by Hovanitz (1941). Mr. Earle A. Cross has found a similar rule in the bee genus *Nomia* (unpublished Master's thesis).

In the subgenus *Epimelissodes* a number of species and subspecies show a series of steps from subspecies through closely related allopatric species. *M. petulca* consists of two subspecies which intergrade in a broad zone across Texas. *M. grandissima* and *M. helianthelli* probably are distinct, closely related species, but may be only subspecies with a relatively narrow zone of intergradation in western Texas. *M. machaerantherae* and *M. comanche* are closely related species which are allopatric as far as is now known. These three pairs of species and subspecies suggest that some sort of a north-south barrier separated populations that are now subspecies or closely related species, and that the species or subspecies differentiated while the barrier existed. At any rate, the above forms show a succession of situations within one genus which illustrate a few probable steps in allopatric speciation.

DESCRIPTIVE METHODOLOGY

In describing species and subspecies below, measurements are given for each species. In a few polytypic species measurements are given instead for each subspecies. The average and standard error is given for each measurement and ratio, except where fewer than 3 specimens were available in which cases the ranges are given. The number (N) of individuals measured applies to all measurements and ratios of the particular sex of each species. In a few instances where it was impossible to take certain measurements owing to the condition of the specimens, the N is given in parentheses immediately before the measurement in question. The total length and width of the bees are given as ranges, since exact measurements were not feasible. The width is the greatest width of the metasoma. For accuracy, the length of the wing was measured from the base of cell 1st M to the apex of the marginal cell. The length of the second flagellar segment of the female and of the first flagellar segment of the male is the shortest length. The method of making these measurements, together with those of the protrusion of the clypeus and relative width of the eye and genal areas, are illustrated in Figures 21 to 23.

References to all known published records are included in the synonymies, except in the case of catalogues, such as Cresson (1879), Dalla Torre (1896), Lutz and Cockerell (1920), Sandhouse (1943) and Michener (*in* Muesebeck *et al.*, 1951), which are omitted in order to avoid undue repetition.

The terminology proposed by Michener (1944) for the male genitalia is followed. Certain descriptive terms are introduced for parts of the genitalia and hidden sterna of the male and these are summarized in Figures 24-27. In the keys and often throughout the various descriptions the terms tergum or terga stand alone without reference to a region of the body. These always refer to the metasoma.

For convenience, a distinction is made between the terms "hair" and "pubescence". The former refers to the erect or suberect, plumose pilosity or to the appressed, relatively simple pilosity, whereas the latter refers to the highly plumose, closely appressed pilosity usually occurring in bands or fasciae, or in an evenly diffuse pattern over the surfaces of the terga. A somewhat special usage of the terms "apical" and "distal" is also introduced when referring to the pubescent bands or fasciae of the terga. The latter is a

general term applying to the second of the two pubescent bands of any tergum but especially of the second tergum, whereas the former term refers to the same bands or fasciae when these are distinctly on or reach the apical margins of the terga. A distinction is made between "pubescent bands" and "pubescent fasciae" of the terga. The latter term refers to the lateral parts of a band when it is interrupted medially, whereas the former term refers to the band as a whole (whether interrupted or not). Of course, these situations are not always exclusive within a species, so that one may speak of interrupted bands and of lateral fasciae which occasionally fuse medially to form a band. The various areas of the tergal vestiture of *Melissodes communis* are diagramed in Figure 20.

In the figures of the male terminalia (Figs. 24-129) the seventh and eighth metasomal sterna are always depicted in ventral view, whereas the spatha, when this is drawn separate from the genital capsule, is always shown in dorsal view. The genital capsules are drawn in either ventral or dorsal view, or both, depending on the need for showing certain structures clearly. With the exception of those of *Melissodes obliqua* (Figs. 24-27) only half of the terminalia are drawn (left half when in dorsal view and right half when in ventral view) in order to conserve space.

TAXONOMIC TREATMENT

KEY TO THE NORTH AND CENTRAL AMERICAN SUBGENERA OF MELISSODES

MALES

1. Last exposed tergum with small apical teeth on side of pygidial plate 4
   Last exposed tergum without lateral teeth 2
2(1). Minimum length of first flagellar segment equal to more than half of maximum length of second segment; antennae short, not reaching or barely reaching scutellum in repose; scapes bright yellow below ..... *Brachymelissodes*
   Antennae of moderate length, reaching beyond scutellum; minimum length of first flagellar segment usually equal to half or less of maximum length of second segment, rarely slightly more than half; scapes not marked with yellow below 3
3(2). Hairs near margin of lateral third of fifth metasomal sternum in two groups, curved evenly away from sternum and sharply bent posteriorly so as to form a semicircle of hooked hairs overlapping last exposed sternum laterally ... *Idiomelissodes*
   Hairs near margin of fifth sternum all straight, not hooked. *Epimelissodes*
4(1). Clypeus protruding beyond eye from ½ to ¾ width of eye in profile; metasomal terga 2 - 5 fringed with narrow marginal

bands of appressed white pubescence, bands much narrower than basal areas of erect or suberect hairs; antennae long, minimum length of first flagellar segment equals less than ⅓ of maximum length of second segment ..... *Apomelissodes*

Clypeus usually not protruding beyond eye by as much as half width of eye in profile, *if* clypeus protrudes as much as or more than half width of eye, *then* minimum length of first flagellar segment equals ⅓ or more of maximum length of second segment; terga usually not fringed by pubescent bands, *if* so, *then* antennae short and marginal bands as wide as or wider than basal areas of terga 5

5(4). Clypeus strongly protruding beyond eye by ¾ or more of width of eye in profile; maximum length of first flagellar segment equals 0.4 or more of maximum length of second segment. *Heliomelissodes*

6(5). Maximum length of first flagellar segment as long as or almost as long as maximum length of second segment and longer than third segment; clypeus wholly black ..... *Psilomelissodes*

Maximum length of first flagellar segment much shorter than maximum length of second segment and distinctly shorter than third segment; clypeus usually pale, occasionally all or partly black 7

7(6). Minimum length of first flagellar segment distinctly more than half of maximum length of second segment; pubescent bands on terga 2 - 5 all apical, subequal in width across each tergum and subequal in width to each other ..... *Tachymelissodes*

Minimum length of first flagellar segment half of maximum length of second segment or less; pale pubescent bands of terga 2 - 4 usually not all apical or subequal in width 8

8(7). Characters of genitalia and hidden sterna 9

External characters 11

9(8). Median apical plates of sternum 7 without hairs on ventral surfaces, usually small, curled ventrally along an oblique axis to form half or more of an oblique cylinder or scroll, but often secondarily flattened and expanded, or reduced in size. *Melissodes*

Median plates of sternum 7 thin, membranous, with short to moderately long hairs on ventral surfaces, not curled ventrally, relatively large 10

10(9). Gonostylus short, less than half as long as gonocoxite, in lateral view twice as broad or more near base than near apex, narrowing abruptly near middle, not capitate; median plates of sternum 7 relatively small, with several short hairs on ventral surfaces ..... *Ecplectica*

Gonostylus short, usually as long as or longer than half of length of gonocoxite, in lateral view not twice as broad near base than near apex, often capitate; median plates of sternum 7 large, with abundant minute to moderately long hairs ventrally. *Eumelissodes*

11(8). Posterior margin of fourth and usually third sternum broadly convex or produced, often forming a broad, thin, hyaline flap. *Eumelissodes*

Posterior margins of third and fourth sterna straight or slightly concave 12

12(11). Terga 2-5 without pale pubescent bands or these all interrupted medially, *if* one or two bands are complete, *then* thorax with hairs mostly black or black and white mixed and labrum all or almost all pale ..... *Melissodes*

Terga 2-5 usually with complete bands, occasionally one or more absent or interrupted medially, *if* only one or two are complete, *then* thorax with bright ferruginous hairs and labrum all or almost all black 13

13(12). Labrum wholly pale; mandibles usually with basal yellow spots; last two metasomal terga with dark brown to black hairs 17

Labrum with at least a dark margin and mandibles often without pale basal spots, *or* last two metasomal terga with pale hairs only, *or* both 14

14(13). Galeae smooth and shiny, without tessellation or shagreening except at tips 15

Galeae dulled by tessellation or shagreening in at least apical half. *Eumelissodes*

15(14). Last two terga with dark brown to black hairs 16

Last two terga with pale hairs only ..... *Eumelissodes*

16(15). Margins of terga 2-4 broadly hyaline, colorless or nearly so, *or* labrum entirely dark brown to black *or* pale spot covers less than half of surface or both ..... *Eumelissodes*

Margins of terga 2-4 opaque, black to reddish-brown; labrum mostly pale-colored, at most with narrow apical margin brown to black ..... *Melissodes*

17(13). Tergum 2 with distal pale band complete or only narrowly interrupted medially, *if* broadly interrupted, *then* basal pale band indistinct, consisting of diffuse pubescence or partly or wholly dark pubescence ..... *Melissodes*

Tergum 2 with distal pale band absent or broadly interrupted medially, each fascia equal to ⅓ or less of width of tergum; basal pale band of tergum 2 distinct ..... *Ecplectica*

FEMALES

1. Clypeus protruding anteriorly beyond eye in profile by ⅔ width of eye; scopal hairs simple or with few branches; postpalpal parts of galeae one and a half times as long as clypeus, *if* shorter, *then* bearing abundant hooked hairs ..... *Apomelissodes*

Clypeus not protruding, or *if* protruding anteriorly beyond eye in profile by as much as ⅔ width of eye, *then* scopal hairs highly plumose and galeae less than 1½ times as long as clypeus; galeae usually without hooked hairs 2

2(1). Clypeus protruding anteriorly beyond eye in profile by half to two-thirds width of eye; inner orbits of eyes often parallel;

hairs of inner surfaces of hind basitarsi dark brown to black (scopal hairs highly plumose) *Heliomelissodes*

Clypeus protruding less less than half width of eye in profile, *if* protruding as much as half width of eye, *then* inner orbits of eyes distinctly converging towards mandibles and/or hairs of inner surfaces of hind basitarsi bright red to yellow (scopal hairs variable, but never simple) 3

3(2). Scopal hairs weak, with few branches, not hiding outer surfaces of hind basitarsi and tibiae; metasomal terga very sparsely and weakly punctate, dulled by dense, fine shagreening and clothed with sparse pubescence and hairs *Psilomelissodes*

Scopal hairs strong, highly plumose, effectively hiding outer surfaces of hind basitarsi and tibiae; or, *if* weak and with few branches, *then* metasomal terga coarsely punctate at least basally, often moderately shiny to shiny and with abundant hairs and pubescence 4

4(3). With basally plumose and apically spatulate hairs in bands between the mesonotum and scutellum and at extreme base of second metasomal tergum; metanotum with thick median tuft of hairs arising from confluent punctures, laterally with short, more or less appressed hairs arising from scattered shallow punctures, *or* lateral areas impunctate 5

Without spatuloplumose hair band between mesonotum and scutellum and usually without spatuloplumose hairs at base of second tergum; without a dense tuft of long hairs medially on metanotum 6

5(4). Middle tibial spur sharply bent or hooked near tip; eye less than twice as long as widest width in facial view *Idiomelissodes*

Middle tibial spur not hooked and only weakly bent, if at all, near tip; eye at least twice as long as wide and usually longer in facial view *Epimelissodes*

6(4). Apical pale pubescent bands on metasomal terga 2-4 reach apical margins of terga, of about same width across terga and subequal in width to each other; plumose hairs of distal pubescent bands arise from distinct round punctures separated by less than one puncture width *or* distal bands as narrow as or narrower than basal area of dark pubescence 7

Apical pale pubescent bands on at least tergum 2 and usually tergum 3 not reaching apices of terga, or, *if* reaching apices of terga, *then* diffuse over entire tergum and not subequal in width to each other and/or not of about the same width across each tergum; tergal punctation and width of distal pale bands variable 8

7(6). Pubescence of apical bands of terga 2-4 arises from distinct round punctures separated by less than one puncture width; posteromedian area of mesoscutum coarsely punctate, punctures separated by one or less puncture width *Brachymelissodes*

Pubescence of apical bands on terga 2-4 not arising from distinct punctures; posteromedian area of mesoscutum sparsely punc-

tate, punctures mostly separated by 2 to 3 or more puncture widths ..... *Tachymelissodes*

8(6). Small bees, 8 to 10 mm. in length; galeae with abundant hooked hairs above, or with short sparse straight hairs and dulled by dense, coarse, regular tessellations ..... *Eumelissodes*

Small to large bees, *if* 10 mm. or less in length, *then* galeae without hooked hairs and either smooth and shiny, except at tips, or only moderately dulled by shagreening or irregular tessellation 9

9(8). Last flagellar segment as short as preceding segment or shorter and about as long as it is wide ..... *Eumelissodes*

Last flagellar segment distinctly longer than the preceding and longer than wide 10

10(9). First tergum with sparse punctures separated mostly by 3 puncture widths or more, except basal fourth or less with more crowded punctures ..... *Eumelissodes*

First tergum with abundant punctures separated by two puncture widths or less in basal half or more 11

11(10). Lateral and ventral surfaces of thorax with dark brown hairs (including propodeum); lateral raised areas of terga 2 and 3 (lateral third of area basal to pale pubescent fasciae) with large, irregular, piliferous punctures, ground areas very shiny, with no tessellation or shagreening; ground areas of supraclypeal area smooth and shiny ..... *Eumelissodes*

Lateral surfaces of thorax with pale hairs at least in some restricted area, or raised areas of terga 2 and 3 with ground areas at least delicately shagreened; supraclypeal area often dulled by dense shagreening or tessellation 12

12(11). Eye narrower than genal area in profile, widest part of eye equals half or less of length; lateral and ventral surfaces of thorax with black hairs ..... *Eumelissodes*

13(12). Hairs of thorax all or almost all black; galeae shiny, without shagreening or tessellation, except at tips.
Melissodes and *Ecplectica*

Hairs of thorax largely pale at least dorsally, *or* galeae moderately shiny to dull due to dense shagreening or tessellation, or both. 14

14(13). Second flagellar segment longer than wide ventrally; hairs of inner surfaces of hind basitarsi brown to black ..... *Eumelissodes*

Second flagellar segment as long as wide or shorter, or hairs of inner surfaces of hind basitarsi red to yellow, or both 15

15(14). Vestiture of metasomal terga entirely black or dark brown, except long hairs on first tergum and occasionally a thin median pale pubescent band on tergum 2; dorsum of thorax with rufescent to ochraceous hairs ..... *Eumelissodes*

Terga with various amounts and arrangements of pale pubescense, never entirely dark except first and second terga, *or* dorsum of thorax with abundant dark hairs, or both 16

16(15). Metasomal tergum 3 either (a) with marginal area covered by the pale pubescent band or nearly so (except median tri-

angular notch less than ⅓ width of tergum), *or* (b) with an impunctate apubescent margin which either markedly narrows laterally from a median notch or is narrower than the pale pubescent band of tergum 2 across the entire tergum.

Eumelissodes

Metasomal tergum 3 with (a) dark hairs apical to the pale band across median third or more of the tergum, *or* (b) with pale hairs in apical area which do not completely hide surface and which differ from those of the pale pubescent band by having no or fewer and shorter branches and usually being erect or suberect (note: punctures when these are worn), *or* (c) with apical apubescent area wider than apical pale band of tergum 2 across the entire tergum 17

17(16). First tergum with broad apical hyaline colorless margin; clypeus with large shiny median boss just below center; hairs of inner surfaces of hind basitarsi dark brown to black ... *Eumelissodes*

Apical margin of first tergum usually opaque or only narrowly hyaline, *if* broadly hyaline, *then either* without a large shiny boss on clypeus *or* inner surfaces of hind basitarsi with red to yellow hairs, or both 18

18(17). Galeae above moderately shiny to dull, with shagreening or tessellation in at least apical half 19

Galeae above smooth and shiny, without shagreening or tessellation except at tips 20

19(18). Metanotum as long as dorsal face of propodeum medially or longer; distal pale band of tergum 2 almost never interrupted medially, with straight anterior margin and evenly curved posterior margin; galeae shiny or moderately shiny, smooth or slightly shagreened ..... *Melissodes*

Metanotum distinctly shorter than dorsal face of propodeum medially; *or, either* distal pale band of tergum 2 interrupted medially or notched along posterior margin, *or* galeae dulled by dense shagreening or tessellation, or both ... *Eumelissodes*

20(18). Dorsal face of propodeum usually without distinct punctures, irregularly rugose, occasionally with small scattered punctures apically but these obscured by dense tessellations and basal half to three fourths irregularly rugose ..... *Eumelissodes*

Dorsal face of propodeum with distinct punctures in at least apical half, ground areas tessellate but not so densely as to obscure punctures, basal half (or less) punctate or reticulo-rugose, not irregularly so 21

21(20). Distal pale pubescent band of tergum 2 uninterrupted medially, evenly curved along posterior margin and of about the same width across tergum ..... *Melissodes*

Distal pale pubescent band of tergum 2 absent or interrupted medially, *or* not evenly curved along posterior margin but conspicuously notched medially 22

22(21). Distal pale band of tergum 2 absent or broadly interrupted medially, the lateral fasciae thus formed well separated from

apical margin of tergum and each fascia no broader medially than half the width of apical area.
Melissodes and *Ecplectica*

Distal pale band of tergum 2 at most narrowly interrupted and lateral fasciae thus formed each much broader than half width of apical area medially ..... *Eumelissodes*

Brachymelissodes, subgenus nov.

Type species. Eucera cressonii Dalla Torre, 1896.

Female. Integument black; tarsi and often tibiae and distal ends of femora rufescent; distal areas of terga somewhat translucent; antennae dark brown above, red or paler below; clypeus, labrum and mandibles often with red or yellow maculae; wing membranes not infumate, slightly milky, veins deep reddish-brown. *Eyes bulbous, width usually considerably more than one third length in facial view, never less;* clypeus evenly convex, width about twice length, with dense, coarse punctures mostly separated by less than one puncture width, ground shiny, with little or no shagreening; second flagellar segment distinctly shorter than broad ventrally and shorter than third segment. Mesoscutum and scutellum with deep round punctures separated by less than one puncture width, ground shiny and smooth; lateral faces of mesepisterna with large, shallow, often confluent punctures, ground delicately shagreened; *tegulae with lateral margins evenly rounded, not narrowed anteriorly;* dorsal face of propodeum densely reticulopunctate, becoming more distinctly punctate posteriorly, often dulled by dense shagreening, declivous face with large median upper impunctate triangle which is smooth and shiny or delicately shagreened, lateral faces and lateral part of declivous face with coarse punctures, ground dulled by dense tessellation; *metanotum with median prominence undeveloped and punctures in lateral areas more distinct than in Epimelissodes.* Metasoma broad, usually about two thirds as wide as long or wider; pygidial plate V-shaped, about as broad basally as long or slightly narrower; *terga 2-4 with small, round, distinct punctures mostly separated by less than one puncture width;* tergum 1 with large deep crowded punctures in basal area, with small punctures in distal area except impunctate marginal fifth or less.

Hairs generally short, more or less appressed on head and dorsum of thorax and metasoma; brown hairs of basal areas of metasomal terga 2-4 and distal area of tergum 1 appressed, extremely short; *terga 2-4 with apical white pubescent bands subequal in width to each other, subequal in width across each tergum and consisting of short diffuse pubescence;* tergum 2 with basal pale

band of appressed pubescence connected at sides with apical pale band of appressed pubescence, *hairs of basal band plumose, not spatulate apically;* erect or suberect bristlelike hairs absent or very sparse on terga 2 and 3, more abundant on terga 4 and 5; *hairs between mesoscutum and scutellum plumose, not spatulate apically; scopa relatively small, hairs with 6 to 12 long thin branches,* pale; hairs of inner surfaces of basitarsi yellow to red.

Male. Color generally as in female; tarsi, usually tibiae and often distal ends of femora rufescent; *antennal scapes wholly yellow or with dark lines dorsally,* flagella dark below and yellow or reddish above. *Eyes very large, width equals half length in facial view or almost so; narrowest part of face about at level of antennal fossae or above; antennae very short, not reaching scutellum, first flagellar segment dorsally equals second segment or slightly less, ventrally equals two thirds of second segment.* Characters of structure and vestiture as in female.

Genitalia and hidden sterna much as in *Epimelissodes*; gonostyli with short sparse hairs; *spatha large, length one third to one half width,* apical margin not evenly rounded—angulate or emarginate. Seventh sternum with lateral excavations of lateral plates usually equal to slightly less than half length of plates; *median apical plates small, without hairs apically;* lateral apodemes gradually tapered, much shorter than median length of sternum. Eighth sternum with lateral apodemes directed somewhat anteriorly.

Key to the Species of the Subgenus

Brachymelissodes

MALES

1. Terga 3 and 4 with apical pale pubescent bands about twice as broad medially as basal areas of dark brown hairs; tergum 2 with pale apical band broadly connected with basal pale band laterally; mesoscutal hairs white to pale ochraceous ..... *minima*

   Terga 3 and 4 with pale apical bands much narrower than basal areas of brown hairs; tergum 2 with pale apical band rarely connected with pale basal band laterally; mesoscutal hairs ochraceous to rufescent ..... *cressonii*

FEMALES

1. Terga 2 to 4 with pale pubescent bands about as wide as basal areas of dark brown hairs; scopal hairs bright yellow; pale mesoscutal hairs usually rufescent ..... *cressonii*

   Terga 2 to 4 with pale bands much broader than basal areas of brown hairs (about twice as broad medially); scopal hairs white; pale mesoscutal hairs white to pale ochraceous ..... *minima*

Melissodes (Brachymelissodes) cressonii (Dalla Torre), new combination

Melissodes brevicornis Cresson, 1872, Trans. Amer. Ent. Soc., vol. 4, p. 281; Crawford, 1903, Can. Ent., vol. 35, p. 334; Cresson, 1916, Mem. Amer. Ent. Soc., vol. 1, p. 113.

Eucera cressonii Dalla Torre, 1896, Catalogus Hymenopterorum, vol. 10, p. 229 (*n. nov.* for *Melissodes brevicornis* Cresson, 1872, *non Tetralonia brevicornis* Smith, 1854).

Xenoglossa brevicornis, Cockerell, 1906, Trans. Amer. Ent. Soc., vol. 32, pp. 73, 102; 1906, Ann. Mag. Nat. Hist., ser. 7, vol. 17, p. 367; 1915, Ent. News, vol. 26, p. 364.

Melissodes petulciformis Cockerell, 1906, Ann. Mag. Nat. Hist., ser. 7, vol. 17, p. 364 (new synonymy); 1928, Univ. Colorado Studies, vol. 16, p. 114.

This species is easily distinguished from *minima* by the larger size, the rufescent thoracic hairs, the bright yellow scopal hairs and the narrower pubescent bands on metasomal terga 2 to 4.

Female. Measurements and ratios: N, 20; length, 10-13 mm.; width, 4.0-5.5 mm.; wing length, M = 3.62 ± 0.186 mm.; hooks in hamulus, M = 13.20 ± 0.213; flagellar segment 1/segment 2, M = 2.30 ± 0.046.

Structure and color: Clypeus usually all black, occasionally with two round or oval, orange or yellow maculae near margin; mandibles usually black basally, rufescent distally with an elongate golden-yellow median mark in distal half, often basal triangle translucent orange; labrum black, occasionally with a rufescent median spot; eyes gray to blue-green. Supraclypeal triangle coarsely punctate, upper part somewhat shagreened; lateral faces of mesepisterna with ground areas shagreened; tergum 1 with ground areas of apical area and tergum 2 with basal area dulled by dense coarse shagreening.

Hair: On head and sides of thorax pale ochraceous; dorsum of thorax with pale hairs ochraceous to ferruginous, often with dark reddish-brown patches on mesoscutum and scutellum. Terga 2-4 with pale pubescent bands about as wide as basal areas of dark brown hairs; pale apical band of tergum 2 connected with pale basal band only at extreme sides or not at all; terga 5 and 6 with long appressed hairs mostly dark brown, white at extreme sides; sternal hairs usually reddish-brown; scopal hairs yellow.

Male. Measurements and ratios: N, 20; length, 9.0-13.5 mm.; width, 3-5 mm.; wing length, M = 3.52 ± 0.188 mm.; hooks in hamulus, M = 12.25 ±0.228; flagellar segment 2/segment 1, M = 1.32 ± 0.020.

Structure and color: Clypeus, mandibular bases and ventral halves or more of scapes bright yellow, black of face usually extend-

ing down over extreme posterior margin of clypeus; labrum pale yellow to white. Sculpturing as in female.

Sternum 7 with lateral excavation of lateral plate equal to or slightly less than half length of plate, broadly open; laterodistal projection of lateral plate acute. Sternum 8 not much narrower medially than apically. Gonocoxite with dorsal projection directed posteriorly, acute; spatha with evenly rounded apical margin except for slight median emargination (Figs. 62-64).

Hair: Generally as in female; thorax usually with rufescent hairs, rarely with brown patches on mesoscutum and scutellum; occasionally with short dark brown suberect hairs at extreme apices of terga 2-4; pale distal band on tergum 2 rarely connected with pale basal band at sides; terga 3-5 with pale distal bands much narrower than basal areas of dark brown hairs; terga 6 and 7 with dark brown hairs, except at sides of tergum 6; sternal hairs brown; legs with hairs golden-yellow.

Bionomics. Little is known of the flower preferences of this species, but females have been collected on widely different sorts of flowers—*Helianthus, Cardia, Vernonia, Polygonum, Euphorbia.* I have observed females collecting pollen from *Euphorbia marginata* in Kansas. A female collected on *Vernonia* in Texas has pollen seemingly from this plant on its scopae. From this evidence *cressonii* can be considered as being polylectic.

Cockerell (1915) has described a resting cluster of a dozen males of this species observed by the Rev. G. Birkmann of Fedor, Texas. The bees grasped the leaves' petioles with their mandibles, swung clear, brushed themselves and remained thus until morning when they were killed.

Type material. Male lectotype of *brevicornis* from Bosque Co., Texas, collected by G. W. Belfrage, is in the Academy of Natural Sciences of Philadelphia. The female holotype of *petulciformis* from Fedor, Lee Co., Texas, is the property of the California Academy of Sciences on temporary deposit at the Citrus Experiment Station, Riverside, California.

Distribution. Southern Nebraska and eastern Colorado south through Kansas and western Oklahoma to Durango, Mexico (Fig. 2). *M. cressonii* has been collected from June 28 to October 2, most abundantly in August and September. From the localities listed below (published records are included) 101 males and 85 females have been examined.

COLORADO: Eads; Holly; Horse Creek (S. of Buckeye); La Junta; Two Buttes Reserve. KANSAS: Burdette; Clay Co.; Coolidge; Decatur Co.; Dickinson Co.; Dodge City (8 miles S. E.); Ellis Co.; Grant Co.; Hugoton (4 miles S. E.); Jetmore (4 miles W.); Lawrence; Manhattan; Meade Co.; Morton Co.; Nickerson; Norton Co.; Randolph; Riley Co.; Stafford Co. NEBRASKA: Lincoln; McCool; Malcolm. OKLAHOMA: Beaver Co. TEXAS: Bexar Co.; Bosque Co.; Clarendon; College Station; Conlen; Corsicana; Cypress Mill, Blanco Co.; Dalhart; Dallas; Dawn; Fedor, Lee Co.; Friona (10 mile N.); Greenville; Hereford (5 miles S. W.); Llano; Olivia; Rosser; Kaufman Co.; Victoria. DURANGO: Tlahualilo.

A single specimen in the U. S. National Museum labeled "Camd. Co., N. J." with no date or collector is presumably mislabeled.

Flower records. Cardia sp., *Euphorbia marginata, Gossypium herbaceum, Helianthus annuus, Medicago sativa, Polygonum* sp., *Prionopsis* sp., *Teucrium canadense, Vernonia* sp.

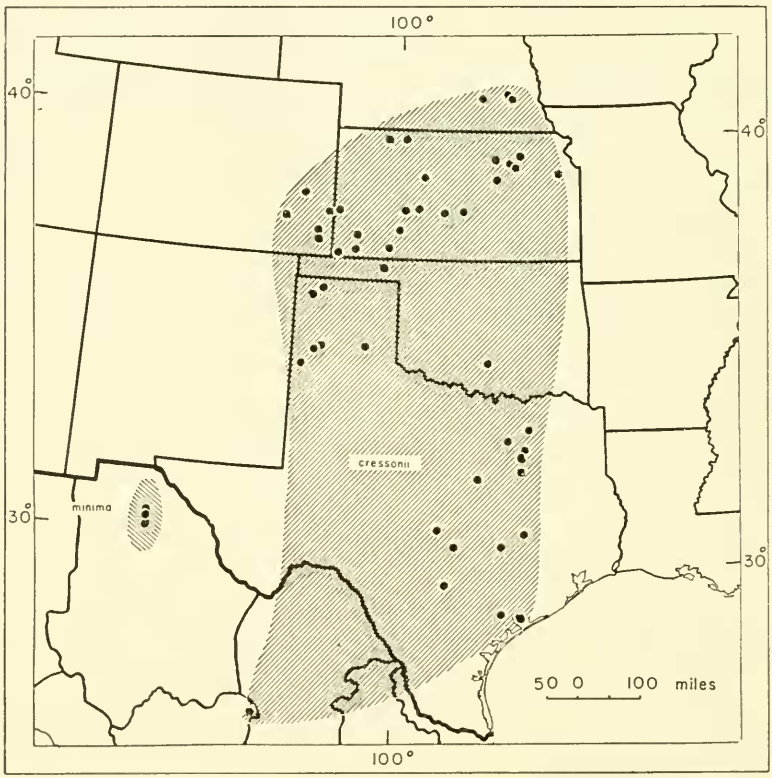

FIG. 2. Map showing the distribution of *M.* (*Brachymelissodes*) *cressonii* and *M.* (*B.*) *minima.*

Melissodes (Brachymelissodes) minima, sp. nov.

This species is readily separated from *cressonii* on the basis of its smaller size, paler color and the broader apical bands on terga 2 to 4.

Female. Measurements and ratios: N, 2; length, about 10 mm.; width about 3.5 mm.; wing length, 3.06-3.15 mm.; hooks in hamulus, 11; flagellar segment 1/segment 2, 2.17.

Structure and color: Clypeus black with a pale yellow, three-lobed macula immediately above the constricted, testaceous, apical margin; labrum and bases of mandibles pale yellow; distal part of mandibles rufescent with a median golden-yellow spot along distal half; eyes grayish-brown; distitarsi rufescent, basitarsi, tibiae and femora dark. Supraclypeal triangle coarsely punctate, ground shiny; lateral faces of mesepisterna with ground smooth and shiny or only delicately shagreened; tergum 1 with ground area of distal area and tergum 2 with ground of basal area delicately shagreened, scarcely dulled; tergum 2 with punctures of basal area small and crowded.

Hair: On head, sides of thorax, legs except distitarsi, inner surfaces of basitarsi and basitibial plates, and pale pubescence of metasoma white; dorsum of thorax with pale ochraceous hairs, scutellum with a few rufescent hairs medially; distitarsi and inner surfaces of basitarsi with yellowish-red hairs; basitibial plates with ferruginous hairs; terga 2-4 with distal pale bands much broader than basal areas of dark brown hairs, about twice as broad medially; tergum 2 with distal pale band broadly connected with basal pale band laterally; terga 5 and 6 with long appressed hairs mostly white, pale brown apically and medially; sternal hairs pale ferruginous; scopal hairs white.

Male. Measurements and ratios: N, 13; length, 8.5-9.5 mm.; width, 3-4 mm.; wing length, $M = 2.95 \pm 0.191$ mm.; hooks in hamulus, $M = 10.23 \pm 0.122$; flagellar segment 2/segment 1, $M = 2.38 \pm 0.035$.

Structure and color: Clypeus, labrum, bases of mandibles and ventral half or more of scapes pale yellow; clypeus not dark posteriorly; flagella pale yellow ventrally and brown dorsally. Other characters of color and structure as in female.

Dorsal projections of gonocoxites curve dorsally and somewhat mesad, blunt apically; spatha about twice as wide as long, with angular apical margin. Sternum 7 with lateral excavations of lateral plates small and deep, slightly constricted by an upturning

of the proximal angle, distal projection blunt, forming an obtuse angle. Sternum 8 much narrowed at apical one third (Figs. 65-68).

Hair: Generally as in female; tergum 2 with distal pale band much broader than basal area of dark brown hairs, broadly connected with basal pale pubescent band laterally; terga 3-5 with distal pale bands narrower than basal area; sternal hairs mostly pale but brown medially and on last exposed sternum; legs, including distitarsi and basitibial plates, with white hairs, but rufescent on inner surfaces of basitarsi.

Type material. Holotype male, allotype female and three paratype males from Villa Ahumada, Chihuahua, Mexico, July 28, 1953, at 3,700 feet altitude on *Cleome* sp., collected by a University of Kansas Mexican Expedition. Nine paratype males and one paratype female from 10 and 13 miles north of Villa Ahumada, Chihuahua, Mexico, July 28, 1953, 3,700 feet altitude, collected by a University of Kansas Mexican Expedition. The holotype and allotype are in the Snow Entomological Museum at the University of Kansas. Paratypes are in the Snow Entomological Museum, the U. S. National Museum and in the author's collection.

Distribution. Known only from the type material, but probably widespread at moderate altitudes on the Mexican plateau (Fig. 2).

Subgenus EPIMELISSODES Ashmead

Epimelissodes Ashmead, 1899, Trans. Amer. Ent. Soc., vol. 26, p. 63; Cockerell, 1906, Trans. Amer. Ent. Soc., vol. 32, pp. 79, 82; Robertson, 1918, Ent. News, vol. 29, p. 92; 1926, Ecology, vol. 7, p. 380; 1928, Flowers and Insects, p. 8; Sandhouse, 1943, Proc. U. S. National Museum, vol. 92, p. 548; Moure, 1944, Papéis Avulsos, Dept. Zool., São Paulo, Brasil, vol. 6, p. 115.

Type species. Melissodes atripes Cresson, 1872, monobasic.

Ashmead placed *Melissodes atripes* in the new genus *Epimelissodes* on the basis of the relative lengths of the submarginal cells (cells one and two being subequal and considerably shorter than the third along their posterior margins) and on the number of segments in the maxillary palpi (three in *atripes*). Robertson (1918) has shown that the venation character is not constant and that Ashmead was in error regarding the palpi which are usually 4-segmented as in most *Melissodes*. Robertson retained the name as a subgenus, including in it three species (*atripes*, *obliqua* and *illinoensis*) which all lack the lateral apical spines on the seventh tergum in the male. *Epimelissodes*, as interpreted here, includes those forms in which the metanotum has a low, rounded, median eminence densely set with long plumose hairs (three to five times as long as the hairs

on the lateral parts of the metanotum) arising from coarse confluent punctures. In addition the males have antennae of moderate length and lack lateral apical spines on the seventh tergum.

Female. Clypeus densely punctate, punctures separated mostly by less than one puncture width and much less near apical margin, ground usually densely tessellate, surface flat, especially posteromedially, projecting forward beyond eye by less than half width of eye in profile, posteromedian area often arising abruptly in a short step from supraclypeal triangle; eyes large, often bulbous, always wider than genal areas in profile; galeae longer than clypeus, usually smooth and shiny with scattered punctures; maxillary palpi 4-segmented, segments 2 and 3 often subequal and usually longer than segments 1 or 2, sometimes with a minute fifth segment. Mesoscutum, scutellum and lateral surfaces of mesepisterna densely and coarsely punctate, ground usually equal to half or less of one puncture width; *metanotum with median rounded eminence densely set with coarse confluent punctures bearing a dense tuft of long plumose hairs and with lateral flat areas with no or smaller and less distinct punctures and short appressed hairs; tegulae oval, not acuminate anteriorly, with lateral margins convex;* dorsal face of propodeum punctate or reticulorugose, ground densely tessellate, declivous face with large distinct punctures and often with a median upper impunctate triangle dulled by dense tessellation, lateral faces with shallow, often more or less confluent punctures and usually entirely tessellate. Pygidial plate V-shaped, rounded apically, as broad basally as long and often broader; sterna densely punctate, with erect or suberect hairs apically, these becoming shorter and more appressed basally. Hairs variable, generally of moderate length, short and more or less recumbent on dorsum of thorax, longer on sides, extremely short and usually appressed on anterior, lower part of lateral face of propodeum; *thick hair band between mesoscutum and scutellum and basal appressed hair band on tergum 2 consist of basally plumose and apically spatulate hairs* (spatuloplumose hairs); scopae large, usually with highly plumose hairs.

Male. Clypeus, labrum and bases of mandibles usually pale cream to bright yellow; clypeus usually slightly longer than half its width, not protruding more than half width of eye in profile, usually much less; eyes large, bulbous, wider in profile than genal areas; *antennae of moderate length, scarcely reaching tergum 1 in repose; maximum length of first flagellar segment equals more than one third of second segment along same side* (dorsal) and often more

than half; galeae and punctation as in female. Thorax much as in female, but often lower lateral and anterior surfaces of mesepisterna covered with a mat of dense appressed hairs. Metasoma much as in female, but often with pubescent fasciae more obscure and erect bristlelike hairs usually more abundant, especially on terga 4-7; *tergum 6 and often tergum 5 with lateral spines, but spines absent on tergum 7*; pygidial plate broad as in female, but often notched laterally near apex; sterna as in female, but less punctate and less piliferous; sternum 7 flat, broadly V-shaped, evenly rounded apically and much broader at base than long, shiny and largely bare, but with short suberect hairs arising from distinct punctures in subtriangular basal area and near apex.

Gonostyli usually with abundant long hairs, often barbed; *dorsal carinae of gonocoxites each produced into a long fingerlike process directed posteriorly and inward; inner apical brush of gonocoxites (below gonostyli) small and composed entirely of short, thick, blunt hairs. Seventh sternum with a deep semicircular emargination near apex of lateral margin of lateral plate; median plate small* with few or no hairs at apex. Eighth sternum broadly truncate and slightly emarginate apically (Figs. 24-27).

This subgenus is divisible into four more or less distinct species groups which are described below. *M. atripes* and *M. albocollaris* are distinct and each forms one of these groups by itself.

KEY TO THE SPECIES OF THE SUBGENUS *Epimelissodes*

MALES

1. Clypeus entirely black ..... *albocollaris*
   Clypeus all or almost all pale 2
2(1). Apical areas of terga with distinct piliferous punctures equal in diameter to several times the width of the simple hairs arising from them (except extremely narrow impunctate margin), ground shiny with little or only delicate shagreening *atripes*
   Apical areas of terga without distinct punctures, *if* punctures present, these small and obscured by dense, diffuse, pale pubescence, ground usually dulled by dense shagreening ... 3
3(2). Terga 2 and 3 with pale pubescence diffuse, extending to apical margins (unless worn); anterior faces of mesepisterna with mats of closely appressed, dense, pale pubescence which hide surfaces completely on at least lower halves 12
   Terga 2 and 3 with pale pubescence in distinct arched bands well separated from margins, in lateral fasciae which are well separated from margins, or absent; mesepisterna often without dense mats of pale pubescence anteriorly 4
4(3). Mesepisterna with mats of dense pale pubescence completely hiding anterior surfaces at least on lower halves 5

Mesepisterna without mats of pale pubescence anteriorly, with short sparse pubescence which does not hide surfaces completely 10

5(4). Mesepisterna with area of small indistinct punctures obscured by dense tessellation extending from anterior faces posteriorly over median half or more of lateral surfaces, upper halves or less and lower parts of lateral surfaces with distinct punctures and smooth shiny interpunctural spaces ..... *texana*

Mesepisterna with uniform punctation laterally, not with lateral surfaces sharply divided into two types of sculpturing, punctures distinct, ground areas usually shiny, if dulled, punctures not obscured 6

6(5). Tergum 2 with distal pale band fused with basal spatuloplumose hair band; inner surfaces of hind basitarsi with yellow to pale red hairs; terga 2 and 3, beneath pale pubescence, with sparse scattered punctures, ground dulled by fine regular tessellation ..... *machaerantherae*

Tergum 2 with distal pale band not usually fused with basal band of spatuloplumose hairs; *if* fused, *then either* inner surfaces of hind basitarsi with dark reddish-brown to black hairs, *or* terga 2 and 3 with distinct punctures separated by less than one puncture width beneath the pale pubescent bands 7

7(6). Tergum 2 with distal pale band fused with basal spatuloplumose hair band at least across median half of tergum and usually completely; terga 3 to 5 with complete pale bands, that of tergum 3 broader medially than apical area of short brown hairs. *helianthelli*

Tergum 2 with distal pale band not fused with basal band, with dark brown hairs or erect pale hairs separating these bands; at least tergum 5 with pale pubescent band interrupted medially by short brown hairs and often pale bands of terga 3 and 4 interrupted as well; tergum 3 with pale band narrower than apical area when not interrupted medially 8

8(7). Tergum 2 with interband zone with coarse punctures separated by less than half a puncture width and about half the size of the coarse punctures in basal half of tergum 1; minimum length of first flagellar segment equals about half of maximum length of second segment and occasionally more, always equal to more than a third of second segment; inner surfaces of hind basitarsi with yellow to pale red hairs ..... *comanche*

Tergum 2 with interband zone with shallow and indistinct punctures *or* with punctures much smaller than half size of punctures of basal half of tergum 1; minimum length of first flagellar segment equals about a third of maximum length of second segment, occasionally slightly more; inner surfaces of hind basitarsi with hairs usually dark reddish-brown to black 9

9(8). Mesoscutum with few or no brown hairs, *if* these present, *then* covering an area smaller than dark patch on scutellum; inner surfaces of hind tibiae and inner and outer surfaces of hind basitarsi with brown hairs ..... *grandissima*

Mesoscutum with patch of dark brown hairs at least as large as dark scutellar patch and usually larger; inner surfaces of hind tibiae and outer surfaces of hind basitarsi with pale hairs, inner surfaces of hind basitarsi with hairs red to dark brown. *aegis*

10(4). Clypeus with posterior margin unevenly marked with brown; inner surfaces of hind basitarsi with orange-red hairs; mesepisterna with punctures on lateral surfaces coarse, slightly larger than those in middle of posterior half of mesoscutum. *nitida*

Clypeus entirely pale in color, except spots at anterior tentorial pits; inner surfaces of hind basitarsi with variable hairs; mesepisterna with punctures on lateral surfaces coarse, but usually of same size as those in middle of posterior half of mesoscutum 11

11(10). Wings usually deeply infumate, or infumate at least basally and anteriorly; inner surfaces of hind basitarsi with dark reddish-brown to black hairs; terga 2 and 3 usually with short appressed brown simple hairs in apical areas (bare only in worn specimens) ..... *obliqua*

Wings clear or somewhat milky, not infumate; inner surfaces of hind basitarsi with yellow to pale red hairs; terga 2 to 4 usually with apical areas bare, or with short appressed plumose white hairs ..... *sila*

12(3). Sternum 7 with lateral excavations of lateral plates half length of plates; sternum 8 without fanlike verticle row of several median apical hairs; mesepisterna with white hairs of lower anterior halves, or more conspicuously more abundant than elsewhere on lateral surfaces, hiding surfaces completely and as thick as pubescence on anterior and ventral surfaces or almost so ..... *sabinensis*

Sternum 7 with lateral excavations of lateral plates slightly shorter than half length of plates; sternum 8 with a verticle row of several stout hairs in median apical emargination forming a fanlike structure; mesepisterna with white hairs on lower anterior halves, or more, of lateral surfaces not conspicuously more abundant than elsewhere on lateral surfaces. *petulca*

FEMALES

1. Scopal hairs all or almost all pale, highly plumose 2

Scopal hairs all or almost all black or dark brown, with few branches and with rachises of hairs extending considerably beyond plumose part so as to form what appears to be a layer of simple guard hairs ..... *atripes*

2(1). Mesepisterna with dark brown to black pubescence on anterior faces, surfaces not greatly obscured; thorax with dark brown to black hairs on sides at least on lower fifth ..... *obliqua*

Mesepisterna with pale pubescence on anterior faces, surfaces often completely obscured on at least lower halves; thorax without dark hairs laterally 3

3(2). Tergum 2, and usually terga 3 and 4 as well, with pale pubescence short, evenly diffused and reaching apical margin 12

Tergum 2, and usually terga 3 and 4, with pale pubescence in arched bands or lateral fasciae and well separated from apical margin by an area of sparse appressed dark hair or by an apubescent area 4

4(3). Terga 2 and 3 with apical areas with short white hairs or entirely bare; inner surfaces of hind basitarsi with yellow to red hairs; mesoscutum without patch of brown hairs, with ground areas shiny, delicately or not at all shagreened ..... *sila*

Terga 2 and 3 with reddish-brown to black, short, appressed hairs (sometimes worn away, especially medially) in apical areas; inner surfaces of hind basitarsi with dark reddish-brown to black hairs *or*, if pale, *then* mesoscutum *either* with a conspicuous patch of dark hairs *or* ground areas dulled by dense shagreening 5

5(4). Tergum 2 with distal pale band fused with basal spatuloplumose hair band across entire tergum; tergum 2, beneath pale pubescence in lateral third, with only a few to several large punctures, surface dulled by regular fine tessellation; supraclypeal area with round large punctures medially; inner surfaces of hind basitarsi with hairs yellow to red.

machaerantherae

Tergum 2 with pale distal band separated from basal spatuloplumose hair band by zone of short brown hairs, *if* latter are pale as the pale pubescence, *then* spatuloplumose band remains sharply defined by virtue of the obvious difference in hair length; tergum 2, beneath or basal to pale pubescent fasciae in lateral third with small punctures separated by less than one puncture width in addition to the large sparse punctures, surface usually dulled by dense irregular tessellation or shagreening; *if* tergum 2 with indistinct punctures, *then* supraclypeal area with indistinct, small, shallow punctures; inner surfaces of hind basitarsi with variable hairs 6

6(5). Mesoscutum with punctures of median half of posterior third (that area immediately before the mesoscutum slants down to the scutoscutellar suture) conspicuously smaller than punctures immediately mesad of parapsidal lines, separated often by more than one puncture width; clypeus rather shiny, with large, deep, rounded punctures and smooth or delicately shagreened ground areas; tergum 4 with white pubescent band not interrupted medially by a patch of brown pubescence.

texana

Mesoscutum with punctures of posteromedian area not conspicuously smaller than those just inside of parapsidal lines; clypeus with small shallow punctures and usually ground dulled by dense shagreening or fine tessellation; tergum 4 with pale pubescent band often interrupted by a median patch of dark brown pubescence 7

7(6). Clypeus with punctures separated by less than half of one puncture width and becoming confluent especially laterally and posteriorly, ground areas and often bottoms of punctures dulled by dense tessellation 8

Clypeus with discrete punctures separated mostly by half a puncture width and usually more in median half of posterior third, at least bottoms of punctures mostly smooth and shiny 9

8(7). Sternal hairs ochraceous to white; pale pubescent fasciae of tergum 2 subtriangular in shape, as wide as apical area laterally; tergum 4 without dark brown pubescence interrupting pale apical band, or only a few dark hairs present ..... *nitida*

Sternal hairs at least partly dark brown; pale pubescent fasciae of tergum 2 narrow, no wider than half of apical area laterally, not subtriangular in shape; tergum 4 with abundant dark brown pubescence interrupting pale apical band medially. *comanche*

9(7). Tergum 4 with median patch of dark brown pubescence as wide as one fourth of tergum and usually much wider; mesoscutum with dark brown hair patch usually larger than that on scutellum, narrowly separated from tegulae laterally; outer surfaces of middle basitarsi with ochraceous hairs ..... *aegis*

Tergum 4 without median patch of dark brown pubescence or this patch not as wide as one fourth of width of tergum; mesoscutum with dark brown hair patch usually rounded anteriorly, well separated from tegulae and scarcely larger than dark scutellar patch, if any; outer surfaces of middle basitarsi with variable hairs 10

10(9). Outer surfaces of middle tarsi with dark brown hairs; scopal hairs of lower half of hind basitarsus brown ..... *grandissima*

Outer surfaces of middle tarsi with pale ochraceous to pale ferruginous hairs; scopal hairs of lower half of hind basitarsus pale ochraceous to white 11

11(10). Clypeus with punctures large and shallow, in posterior third of median half separated mostly by one puncture width or more; tergum 2 with distal pale band uninterrupted or only narrowly so; tergum 3 with pale band uninterrupted, medially as wide as apical area or almost so ..... *helianthelli*

Clypeus with punctures smaller and deeper, in posterior third of median half separated mostly by half a puncture width or less, rarely by as much as one puncture width; tergum 2 with distal pale band broadly interrupted medially (by ¼ to ⅓ width of tergum); tergum 3 with pale band narrowly interrupted medially, or thinned to less than ⅓ width of apical area medially ..... *nitida*

12(3). Mesoscutum without brown hairs and scutellum usually without brown hairs; tergum 2 with apical band of diffuse pubescence not reaching margin of tergum and on tergum 3 not reaching margin at least medially ..... *sila*

Mesoscutum often with brown hairs in posteromedian area; terga 2 and 3 with apical bands of diffuse pubescence reaching apices of terga (unless worn away) 13

13(12). Terga 2 and 3 with punctures of lateral raised areas (interband zone immediately mesal to lateral arms of graduli) coarse, deep, scarcely obscured by tessellation; terga 3 and 4 with brown hairs basal to apical pale bands of diffuse pubescence. *petulca*

Terga 2 and 3 with punctures of interband zone (laterally) shallow and obscured by dense tessellation, those of tergum 3 distinctly separated into smaller, shallower punctures bearing plumose hairs and larger, sparser punctures bearing bristlelike hairs; terga 3 and 4 often with only pale hairs and tomentum basally ..... *sabinensis*

THE ATRIPES GROUP

Melissodes (Epimelissodes) atripes Cresson.

This species is readily distinguished from the other *Epimelissodes,* except *M. albocollaris,* by the distinct, large, shallow punctures separated by one or less puncture width in the apical areas of metasomal terga 2 and 3 of both sexes. The pale yellow clypeus and labrum serve to distinguish the males from those of *albocollaris.* In addition the females are readily recognized by the dark brown or black scopae which have peculiar hairs as described below.

Female. Measurements and ratios: N, 51; length, 15-20 mm.; width, 6-8 mm.; wing length, $M = 6.18 \pm 0.064$ mm.; hooks in hamulus, $M = 19.06 \pm 0.654$; length of flagellar segment 1/segment 2, $M = 1.74 \pm 0.034$.

Structure and color: Integument black, except for distitarsi and apical spurs of middle and fore tibiae which are rufescent, mandibles which are black in basal triangle and red distally with a longitudinal golden-yellow macula extending over distal half to one third; eyes dull bluish-gray to yellowish-green; tegulae testaceous in pale forms to clear brown in dark forms; wing membranes infumate, deep brown with violet reflections in dark forms to a rather clear brown in pale forms, veins dark red to blackish-brown, being usually paler basally; antennae black except for an elongate reddish spot on outer half of ventral surfaces of flagellar segments 2 to 10, occasionally entire ventral surface reddish-brown, or all brown in dark forms.

Second flagellar segment almost always longer than broad ventrally, never shorter; clypeus slightly more than half as long as width of face between lower ends of eyes; supraclypeal area with large deep punctures, ground usually densely tessellate; eyes slightly more than one third as wide as long in facial view, essentially parallel, narrowest space between eyes at vertex usually

equal to or only slightly wider than narrowest space just above mandibles, face slightly wider about one third of distance from top of eyes; clypeus equals five eighths of postpalpal parts of galeae; maxillary palpi usually 4-segmented in ratio of about 2.5:4:4:1.5. Mesoscutum, scutellum and lateral surfaces of mesepisterna densely and coarsely punctate, ground more or less dulled by shagreening, densely so on posterior third to half of mesoscutum; dorsal face of propodeum reticulopunctate, entire propodeum dulled by dense tessellation. First metasomal tergum less than half as long as wide, with deep dense punctures separated by half or less of one puncture width on anterior half and extending almost to apex laterally, with smaller and shallower but distinct punctures on distal half, ground dulled by shagreening, but less so on basal half; terga 2, 3 and 4 similar, but punctures shallower and more irregular in size in basal areas; each tergum with a narrow, impunctate apical zone.

Hair: Pale ochraceous on head in pale forms; labrum and vertex often with some brownish hairs, this brown progressively spreading onto face and genal areas until all hairs of head dark brown to black in darkest forms. Dorsum of thorax, propodeum, tegulae and lateral faces of mesepisterna with pale ochraceous hairs in pale forms, brown hairs of anterior and ventral faces of mesepisterna in pale forms progressively cover mesepisterna and appear on scutellum, posteromedian area of mesoscutum and tegulae in dark forms; thick hair band between mesoscutum and scutellum with few spatuloplumose hairs and occasionally none. Metasomal tergum 1 with long pale ochraceous hairs in basal half, short dark brown appressed hairs in distal half and with rather short ephemeral lateral fasciae of dark brown plumose hairs medially, with appressed pale ochraceous or dark brown hairs at extreme sides and with whitish spatuloplumose hairs in appressed basal band, often the latter hidden under apex of first tergum; tergum 3 similar, but pubescent fasciae often white and without basal spatuloplumose hair band; tergum 4 similar, but pubescent fasciae broad, apical and usually continuous across tergum, sometimes white laterally; sternal hairs coarse, erect, dark brown to black, shorter appressed basal hairs brown, sparse. Scopae with dense long dark brown to black hairs, median area of tibial scopae with pale ochraceous to pale brown hairs in pale forms; scopal hairs of metatarsi and lateral and distal hairs on tibiae with few branches (8 to 12) and with rachises extended to form stiff unbranched

apical projections about as long as branched parts of hairs, these form a layer over the exterior of the scopae appearing like a layer of simple guard hairs. Hind basitarsi with dark brown to black hairs on inner surfaces; fore and middle legs and hind femora usually with dark brown to black hairs.

Male. Measurements and ratios: N, 51; length, 13-18 mm.; width, 4.5-7.0 mm.; wing length, $M = 5.76 \pm 0.054$ mm.; hooks in hamulus, $M = 17.10 \pm 0.205$; length of flagellar segment 2/segment 1, $M = 2.14 \pm 0.016$.

Structure and color: Black, sterna and distitarsi often rufescent; antennal scapes dark brown to black, flagella dark brown beneath and reddish above; eyes gray to yellowish-green; tegulae testaceous; wing membranes and veins as in female.

Clypeal width about 1.3 times length or slightly more; sculpturing of head similar to female, but obscure on clypeus; eyes bulbous, about half as wide as long in facial view or slightly wider, converging below, narrowest facial width about at level of tentorial pits; galeae equal to about half length of clypeus; maxillary palpi as in female, but often fourth segment shorter and often with extremely short fifth segment. Punctation of thorax and metasoma as in female, but sterna with fewer hairs and punctures.

Gonostyli with abundant long hairs, ventrally all plumose, dorsally about half plumose and half simple; dorsal projections (= carinae) of gonocoxites blunt and curving inwards; spatha evenly curved apically; sternum 7 with lateral excavation of lateral plate small, about one third as long as plate; posterior apodemes equal to median length of sternum or slightly less; median plate with abundant long hairs. Sternum 8 with lateral apodemes acute, directed somewhat anteriorly; central apical carina blunt, not extending forward to surpass apical margin medially (Figs. 39-41).

Hair: Much as in female, but generally paler; clypeus and vertex with dark hairs only in darkest forms, head never wholly dark. Lateral faces of mesepisterna always with pale hairs, anterior faces often with pale hairs, but dark in dark forms, ventral faces with a small patch of appressed dark hairs usually present; pronotum, mesoscutum and scutellum without dark hairs; tegulae with brown hairs in dark forms. Metasomal terga as in female with the following differences: tergum 2 often with short thin white pubescent fasciae laterally, terga 3 and 4 as in tergum 3 of female, but white fasciae often continuous, tergum 5 never with white pubescence laterally. Legs with pale ochraceous hairs except dark brown hairs

on outer surfaces of basitarsi and inner surfaces of hind tibiae in pale forms, becoming entirely dark brown to black in dark forms; inner surfaces of basitarsi with rufescent to dark brown hairs.

Bionomics. According to the evidence from published records, from the locality records of bees studied and from the author's own collecting experience, *M. atripes* is restricted in nesting sites to sandy areas.

Robertson (1914 and 1926) regarded this bee as oligolectic on *Cassia chamaecrista.* This is erroneous, since it has not been collected on *Cassia* in any part of the country except Illinois. In Kansas *atripes* has been observed collecting pollen from *Dalea lanata* and *Cleome serrulata* and Brimley (1938) reports it as being polytropic in North Carolina. However, this species, unlike most *Melissodes* (and especially unlike other species of the subgenus *Epimelissodes*), seemingly does not collect pollen from and only rarely visits composites. Thus far only two females have been collected visiting composites by the author (one on *Gaillardia* and one on *Thelesperma megapotamicum* near Portales, N. Mex.), but in neither case was there any evidence of pollen collecting by the bees. In addition, Robertson (1928) has recorded the female on *Bidens aristosa* and *Vernonia fasciculata* in Illinois, again not collecting pollen. The modified scopal hairs of the female may be involved in this habit of visiting flowers of the non-Compositae. However, since these bees collect from very different flowers and since we know nothing of the details of pollen gathering, the relationship is obscure.

Hart and Gleason (1907) in their study of the biology of the sand areas of Illinois report that this species was found apparently resting in large numbers clustered on dead weed stems along the roadside. Unfortunately, they do not record whether both sexes were involved, or only males as has been recorded in other species of *Melissodes.*

Geographical variation. The fact mentioned above that *atripes* is dependent upon sandy areas for nesting sites has strongly affected its distribution. These bees are perhaps most abundant in eastern Texas where there are large sandy areas and sufficient precipitation to provide the bees with the proper plants to serve as food sources. They are also common along the Atlantic coast from Florida as far northwards as New Jersey. They are less common in the Gulf States where sandy areas are less common. Elsewhere the species is most common along rivers and streams. In Kansas it is common in the sand dunes along the Arkansas River and has been taken

in sandy areas in the upper reaches of the Cimarron and Canadian rivers and in one locality along the Kaw River. In western Texas and eastern New Mexico it has been taken in sandy areas along the Canadian River. In Illinois it is common in the sand dunes along the Illinois River and its tributaries northward to about the middle of the State. This dependence on sand results in a spotty distribution which makes difficult the study of clines and related phenomena.

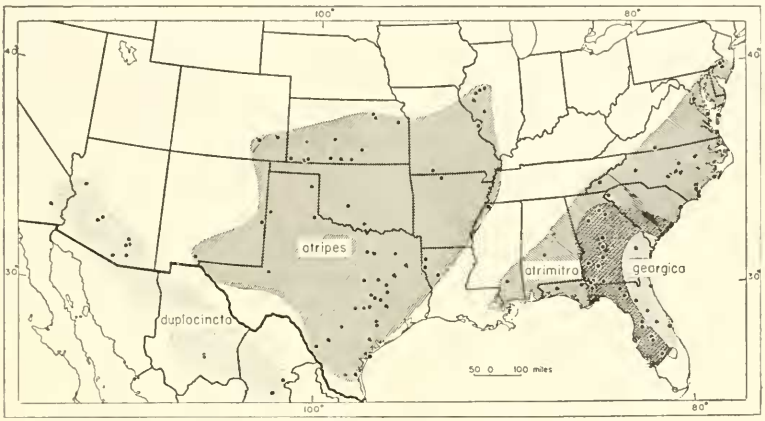

FIG. 3. Map showing the distribution of *M. (Epimelissodes) atripes* and *M. (Idiomelissodes) duplocincta*. In *M. atripes* the zone of intergradation between the subspecies *atrimitra* and *georgica* is indicated by the overlapping type of shading, whereas the zone between the subspecies *atripes* and *atrimitra* is left unshaded due to a lack of specimens from that area.

This species varies geographically with regard to the number and arrangement of the white pubescent fasciae on the metasoma and of the dark brown hairs on the metasoma, thorax and head. In Tables I and II are tabulated percentages of several of these characters for females and males. The data have been grouped rather roughly because of the lack of sufficient material, because of discontinuous distribution and because of the haphazard nature of the collections. The grouping, although unrefined, is logical. Drainage was taken into consideration as well as major breaks in distribution.

In spite of these difficulties a cline can be seen in the western part of the range of this species. The cline shows especially well in the white fasciae of the metasoma. The palest forms are most abundant in Kansas and Colorado and become less abundant to the east in Illinois and Missouri and to the south in Texas. The Oklahoma, New Mexico and western Texas specimens were found to be

very similar and, together or separately, they are intermediate between the Kansan and Texan populations.

A sharp break can be seen between the above populations and the populations along the Gulf coast. The transition zone between the western and the Gulf States' populations cannot be studied because of the lack of material from critical areas. However, the cline in the western populations indicates that a rather narrow zone of intergradation must exist across Louisiana. I have seen only three males from Louisiana and these are from near the eastern edge of the state. These males are easily assignable to the Texan population. Two males from the extreme northwestern corner of Mississippi (DeSoto County) also belong with the western populations. The bees may well be rare across this hypothetical zone of intergradation because of a lack of suitable sandy habitats, resulting in restricted gene flow across the area.

TABLE I.—Percentages of females of *Melissodes atripes* exhibiting certain characters of vestiture (see text).

CHARACTERS	COLORADO AND KANSAS (33 specimens)	OKLAHOMA, NEW MEXICO, WESTERN TEXAS (20)	TEXAS (east and central) (79)	ILLINOIS AND MISSOURI (33)	MISSISSIPPI (5)	MARYLAND, NEW JERSEY AND VIRGINIA (18)	NORTH CAROLINA AND SOUTH CAROLINA (24)	GEORGIA (north and central) (5)	GEORGIA (southwest), FLORIDA (western) AND ALABAMA (9)	FLORIDA (eastern) (11)
A	0	0	2.5	18.2	100.0	100.0	95.8	40.0	100.0	9.1
B	18.2	25.0	73.4	72.7	0	0	4.2	60.0	0	9.1
C	81.8	75.0	24.1	9.1	0	0	0	0	0	81.8
D	75.0	70.0	27.8	24.2	0	0	33.3	20.0	22.2	0
E	6.9	10.0	0	0	0	0	0	60.0	11.1	90.0
F	8.3	30.0	34.2	57.6	100.0	100.0	91.7	80.0	88.9	0
G	0	0	1.3	12.1	100.0	100.0	41.7	0	100.0	0
H	69.4	55.0	49.4	18.2	0	16.7	29.2	100.0	55.6	100.0
I	0	5.0	0	9.1	100.0	94.4	45.8	0	100.0	0

TABLE II.—Percentages of males of *Melissodes atripes* exhibiting certain characters of vestiture (see text).

CHARACTERS	COLORADO AND KANSAS (43 specimens)	OKLAHOMA, NEW MEXICO, WESTERN TEXAS (20)	TEXAS (east and central) (149)	ILLINOIS AND MISSOURI (54)	MISSISSIPPI (14)	MARYLAND, NEW JERSEY AND VIRGINIA (10)	NORTH CAROLINA AND SOUTH CAROLINA (32)	GEORGIA (north and central) (5)	GEORGIA (southwest), FLORIDA (western) AND ALABAMA (10)	FLORIDA (eastern) (40)
A	0	0	2.0	0	85.7	80.0	43.8	0	20.0	5.0
B	18.6	35.0	42.9	52.9	0	10.0	25.0	60.0	60.0	17.5
C	0	15.0	2.7	1.9	7.1	0	21.5	0	0	5.0
D	55.8	35.0	45.0	39.6	0	10.0	9.7	20.0	20.0	2.5
E	25.6	10.0	7.4	5.6	7.1	0	0	20.0	0	70.0
F	0	0	0	0	0	0	0	0	0	52.5
G	58.1	35.0	83.2	92.6	35.8	30.0	84.4	60.0	80.0	20.0
H	41.9	50.0	11.4	7.4	7.1	0	5.9	40.0	20.0	77.5
I	0	5.0	0	0	0	0	0	0	10.0	47.5
J	62.8	65.0	40.3	12.9	14.3	20.0	71.9	20.0	90.0	50.0
K	34.9	30.0	1.3	0	0	10.0	9.7	0	30.0	80.0

The dark form of the Gulf States is seen to intergrade in western Florida and southwestern Georgia with another pale population occupying eastern Florida and southeastern Georgia. Again the paucity of material from critical areas makes the study of the zone of intergradation difficult. However, specimens from extreme western Florida and those from southwestern Georgia are more like the dark specimens from the Gulf States than like the pale eastern specimens. A relatively long series of specimens from Suwanee Springs in northern Florida contains all intergrades from one extreme to the other. Intergrades also occur down the western half of the Florida Peninsula.

The dark form of the Gulf States probably has a continuous range

with the dark forms appearing in North Carolina, Maryland, New Jersey and Virginia. From the material now before me the range is broken by intergrades between the dark specimens and the southeastern pale specimens. The population in northcentral Georgia is intermediate in character. It should be noted that the generally darker specimens from southwestern Georgia are not separated by much distance from the intermediate forms from northcentral Georgia, but these occupy different drainage systems. The southwestern specimens were all collected in the drainage area of the Apalachicola River which empties into the Gulf of Mexico, whereas the specimens from northcentral Georgia were all collected in the drainage systems of the Altamaha and Savannah rivers which both empty into the Atlantic Ocean in southern Georgia. The differences between the populations is thus explainable, assuming that migration and resulting gene flow is made possible, or at least aided, by sandy areas along the courses of these streams. To the north evidence of gene flow from the south is present in collections from North Carolina, but as one can see from Table I, a large majority of the females are assignable to the dark form. The seemingly more extensive intergradation to the north rather than to the west is perhaps due to the ease of migration along the sandy areas along the coast. In the northern part of the range of the dark form, both males and females tend to have yellow-green eyes, rather than the usual gray or blue-gray. Eye-color of museum specimens is a notoriously poor character and the significance of this observation must await confirmation from live bees.

The pale southeastern form (subspecies *georgica*) may have evolved while isolated from the mainland populations on one or more islands which now form the Florida peninsula. The dark form (subspecies *atrimitra*) probably has become differentiated from the western form (subspecies *atripes*) due to the restriction of gene flow across the state of Louisiana because of the lack of sandy habitats resulting from the muddy deposits of the Mississippi River. This species has not yet been collected in Tennessee, Kentucky, northern Alabama and the states bordering the Ohio River to the north. Collections from those areas, if the bees occur there, may well change the results of this study (Fig. 3).

Each of the characters listed in Tables I and II is an all or nothing situation. Several of these "characters", however, may be grouped as steps in a single broadly variable character. Thus, characters A, B, and C of Table I are mutually exclusive and are steps in a

progression from darkest (A) to palest (C). Such groupings are indicated by the double horizontal lines in the tables. The characters, represented only by letters in the tables, are listed below:

Table I—Females.

A. Without white pubescent fasciae on metasoma.
B. Tergum 3 with white fasciae (but not tergum 4).
C. Terga 3 and 4 with white fasciae.
D. Tergum 2 with pale hairs present at extreme sides (but not tergum 3).
E. Terga 2 and 3 with pale hairs at extreme sides.
F. Face with 10% or more of hairs dark brown to black.
G. Face with 50% or more of hairs dark.
H. Mesepisterna with upper triangular area of pale hairs extending half way or more from wing bases to middle coxae.
I. Pronotum (posterior lobes and/or dorsally) and mesoscutum with some dark brown or black hairs.

Table II—Males.

A. Metasoma without white pubescent fasciae or bands.
B. Tergum 2 with white fasciae (but not terga 3 or 4).
C. Terga 3 and 4 with white fasciae (but not tergum 2).
D. Terga 2 and 3 with white fasciae (but not tergum 4).
E. Terga 2, 3 and 4 with white fasciae (tergum 3 with or without a complete white band).
F. Both terga 3 and 4 with complete bands of white pubescence (tergum 2 with white fasciae).
G. Tergum 2 with pale hairs at extreme sides (but not tergum 3).
H. Terga 2 and 3 with pale hairs at extreme sides.
I. Mesepisternal hairs all pale.
J. Mesepisterna with dark hairs below and often anteriorly.
K. Hind femora without dark hairs above.

One notices in Tables I and II that the males in all of the populations are much more variable than the females in the characters studied. The cline existing in the western subspecies and the areas of intergradation are nonetheless recognizable. This variability of the males may be due to the haploid nature of the males in contrast to the diploidy of the females. Recessive genes are thus always expressed in the males, but may be hidden in the heterozygous state in the females. The percentage of males in which such recessive genes are expressed is equal to the frequency of the genes in the population, whereas it is somewhat less in females from the same population.

Because of the variation described above, three subspecies of *atripes* are recognized and described below. A fourth subspecies may possibly exist in the northern part of the range of *atrimitra,* but this decision must await further material and field studies. The females of these three subspecies are rather easily separated, but the males on account of their greater variability cannot be easily recognized.

Melissodes (Epimelissodes) atripes atripes Cresson.

Melissodes atripes Cresson, 1872, Trans. Amer. Ent. Soc., vol. 4, p. 275; Cragin, 1886, Trans. Acad. Sci. St. Louis, vol. 8, p. 54; Cockerell, 1899, Ent. News, vol. 10, p. 4; Bridwell, 1899, Trans. Kansas Acad. Sci., vol. 16, p. 211; Robertson, 1900, Trans. Acad. Sci. St. Louis, vol. 10, p. 53; 1905, Trans. Amer. Ent. Soc., vol. 31, p. 369; Cockerell, 1906, Trans. Amer. Ent. Soc., vol. 32, pp. 79, 82; Hart and Gleason, 1907, Bull. Illinois State Lab. Nat. Hist., vol. 7, p. 257; Robertson, 1914, Ent. News, vol. 25, p. 73; Cresson, 1916, Mem. Amer. Ent. Soc., vol. 1, p. 112; Cockerell, 1934, Amer. Mus. Nov., no. 697, p. 10.

Epimelissodes atripes, Ashmead, 1899, Ent. News, vol. 10, p. 245; Robertson, 1918, Ent. News, vol. 29, p. 92; 1926, Ecology, vol. 7, p. 380; 1928, Flowers and Insects, p. 8.

Female. Differing from females of *atrimitra* by the paler hairs of the face (almost always with less than 50 percent dark brown hairs and most with less than 10 percent dark brown hairs on face exclusive of clypeus and vertex) and by usually having white pubescent fasciae on metasoma (usually on both terga 3 and 4, but often on tergum 3 only). Less easily distinguished from females of *georgica,* but a majority of females of *atripes* can be distinguished as follows: usually with pale hairs at sides of metasomal tergum 2 only; pale hairs on mesepisterna usually form a triangle on upper half or less of each mesepisternum; usually without pale ochraceous scopal hairs on hind tibiae. Additional characters can be seen in Table I.

Male. M. atripes atripes may be separated from *atrimitra* by almost always having some white pubescent fasciae on metasoma and by never having dark brown hairs on face, clypeus or tegulae. Separable from paler forms of *georgica* by only rarely having continuous bands of white pubescence on metasomal terga (only that on tergum 3 complete, if any) and by usually not having lateral white fasciae on more than two of the terga. Additional characters can be seen in Table II.

Type material. Holotype female collected by G. W. Belfrage from Texas, in the U. S. National Museum (USNM Type No. 24,615).

Distribution. From New Mexico northwards to eastern Colorado,

east to central Illinois and south to northwestern Mississippi, Arkansas and Texas (Fig. 3). These bees have been collected from May 2 to October 30 in the southern part of the range and from July 21 to September 3 in the northern part of the range. Specimens examined from the localities listed below include 275 males and 218 females. Localities referred to in the literature are included.

Arkansas: Marion Co. Colorado: Lamar; Rocky Ford. Illinois: Bath; Havanna; Manito; Meredosia; Carlinville. Kansas: Coldwater; Comanche Co.; Garden City; Harper Co.; Larned; Lawrence (8 miles S.); Liberal; Manhattan; Morton Co.; Riley Co.; Sedgwick Co.; Seward Co.; Barber Co. Louisiana: Keatchie; Natchitoche Co.; Shreveport. Mississippi: DeSoto Co. Missouri: Branson; St. Louis. New Mexico: Dona Ana Co.; Portales. Oklahoma: Anadarko; Ardmore. Texas: Austin; Bexar Co.; Brazo Co.; Brooks Co.; Calvert; Canadian; Friona; Grapevine; Groesbeck; Laredo; Lee Co.; Madison Co.; McDade; Metz, Ector Co.; Mifflin; Mineola; Navasota; Overton; Padre Island, San Patricio Co.; Palestine; Peeler; Rock Island; San Gabriel River; Skull Creek, Colorado Co.; Victoria; Waco.

Flower records. Except for the few exceptions mentioned above, the females have not been collected from composites. *Asclepias incarnata, Bidens aristosa, Cassia fasciculata, Cleome serrulata, Dalea lanata, Gaillardia* sp., *Gonolobus laevis, Gossypium herbaceum, Helianthus annuus, Ipomoea pandurata, Lythrum alatum, Melilotus alba, Pycnanthemum virginianum, Thelesperma megapotamicum, Verbena hastata, V. stricta, Vernonia fasciculata.*

Melissodes (Epimelissodes) atripes atrimitra, subsp. nov.

Melissodes atrifrons, Cockerell (*non* Smith, 1854), 1906, Trans. Amer. Ent. Soc., vol. 32, pp. 79, 82; Smith, 1910, Ann. Report New Jersey State Museum, 1909, p. 693 (Fox det.).
Melissodes atripes, Smith (*non* Cresson, 1872), 1910, Ann. Report New Jersey State Museum, 1909, p. 693 (Fox det.).
Melissodes carolinensis, Brimley (*non* Dalla Torre, 1896), 1938, Insects of North Carolina, p. 462; Michener, 1947, Amer. Mid. Nat., vol. 38, p. 454.

Smith (1854, pp. 307 and 308) proposed the name *atrifrons* for two species of *Tetralonia*, the first a male from Chile and the second a female from Warm Springs, North Carolina (R. Foster, collector). Dalla Torre (1896) proposed the name *carolinensis* for the North Carolina female, after having placed all of the species of *Tetralonia* and *Melissodes* in the genus *Eucera*. Since then, this subspecies has been known variously as *atripes*, *atrifrons* or *caro-*

linensis following the lead of Cockerell (1906). Dr. I. H. H. Yarrow of the British Museum in a recent communication (dated September 17, 1954) has informed me that the female type of Smith's *Tetralonia atrifrons* (from North Carolina) is indeed a *Tetralonia* and not a *Melissodes*. The name *atrimitra* is therefore proposed for this subspecies of *M. atripes*.

Female. Almost always with more than 50 percent dark brown hairs on face, hairs of head all dark brown in darkest specimens; often with less than 50 percent pale hairs on lateral surfaces of mesepisterna; usually with dark brown hairs on posterior lobes of pronotum, along extreme anterior margin of mesoscutum and often on tegulae; small posteromedian patch of brown hairs on mesoscutum and median patch on scutellum in dark specimens; usually with no white pubescent fasciae on metasomal terga and without pale hairs at extreme sides of tergum 3 and usually absent at sides of tergum 2; scopal hairs always dark brown to black.

Male. Darkest forms without pale hairs at sides of metasomal terga and without white pubescent fasciae; often with dark brown hairs on clypeus, vertex and tegulae; usually with dark brown hairs on anterior as well as lower surfaces of mesepisterna; hind legs usually without pale hairs. The tabulation in Tables I and II give additional information regarding both sexes.

Type material. Holotype male, allotype female, 2 female and 4 male paratypes from Hattiesburg, Mississippi, August 6, 1944, C. D. Michener. Two female and nine male paratypes from Hattiesburg, Mississippi, collected by C. D. Michener are as follows: 5 males, July 23, 1944; 2 males, July 29, 1944; 2 males and 2 females, August 13, 1944. The holotype and allotype are in the Snow Entomological Museum at the University of Kansas. Paratypes are in the Snow Entomological Museum, the American Museum of Natural History, the Citrus Experiment State, Riverside, California, and in the author's collection.

Distribution. Gulf States from Mississippi to Alabama, northeast across western Georgia to North Carolina and north to New Jersey (Fig. 3). This subspecies has been collected from July 29 to November 30. Specimens examined from the localities listed below include 95 males and 52 females (including type material).

ALABAMA: Selma. FLORIDA: * Bartow; * Branford; Crestview; * Fort Meade; * LaBelle; *Lacooche; Marianna; * Suwanee Springs; * Tallahassee; * Wildwood. GEORGIA: * Albany; * Athens; * At-

* Localities considered to be in the zone of intergradation.

lanta; * Bainbridge; * Butler's Ferry, * Decatur Co.; * Cordele; * Fort Valley; * Macon; * Perry; * Shellman; * Spring Creek, Decatur Co.; * Thomasville; * Thomson's Mills. Maryland: Indianhead. Mississippi: Hattiesburg. New Jersey: Rancocas Park; Haddenfield; Camden County. North Carolina: Boque; Bryson City; Burgaw; Carolina Beach; Castle Haymes; Harnett; Hickory; Kingsboro; Lakeview; Overhills; Raleigh; Southern Pines; Spout Springs; Wilmington. South Carolina: Jocassee; * Myrtle Beach. Virginia: Camp Peary; Henry Co.; Seven Pines; Virginia Beach.

Flower records. Bradburya virginiana, Buddleia sp., *Gerardia* sp., *Gossypium herbaceum, Hibiscus* sp., *Koellia hysopifolia, Kuhnistera* sp., *Monarda punctata, Passiflora incarnata, Primula vulgaris.*

Melissodes (Epimelissodes) atripes georgica Cresson.

Melissodes georgica Cresson, 1878, Proc. Acad. Nat. Sci. Philadelphia, vol. 30, p. 200; Cockerell, 1906, Trans. Amer. Ent. Soc., vol. 32, p. 79; Cresson, 1916, Mem. Amer. Ent. Soc., vol. 1, p. 119; Fattig, 1945, Emory Univ. Mus. Bull., no. 3, p. 5.

Female. Face with more than 10 percent pale hairs; tegulae, posterior lobes of pronotum and anterior margin of mesoscutum usually without brown hairs; posteromedian area of mesoscutum and median area of scutellum with a small patch of brown hairs; pale hairs on lateral surface of mesepisternum not forming a dorsal triangle, but covering entire lateral surface or almost so; metasomal terga 3 and 4 usually with white pubescent fasciae and usually with pale ochraceous hairs at extreme sides; scopae of hind tibiae with pale, almost colorless hairs medially.

Male. Males distinguished from both other subspecies by usually having complete white pubescent bands on terga 3 and 4, or at least on tergum 3, and usually having white lateral fasciae on tergum 2 in addition; clypeus, vertex and tegulae usually without brown hairs; usually with only pale hairs on anterior faces of mesepisterna and often those on ventral surfaces also pale; hairs of middle and fore legs and of outer surfaces of hind tibiae and femora pale ochraceous. Additional characters tabulated in Tables I and II for both sexes.

Type material. Holotype male from Georgia in the Academy of Natural Sciences of Philadelphia.

Distribution. Eastern half of Florida and coastal region of Georgia (Fig. 3). The subspecies *georgica* has been collected flying from July 3 to October 16 (these dates include the inter-

* Localities considered to be in the zone of intergradation.

grading series from western Florida). Specimens studied include 11 females and 16 males from the localities listed below. The type specimen from Georgia is presumably from the coastal area, probably from near Savannah. In addition to those listed below, many specimens, especially males, from localities in the zone of intergradation listed under *atrimitra* could be assigned to *georgica*, but are not because they were collected in series containing all forms from one extreme to the other.

FLORIDA: Cocoa; Gainesville; Jacksonville Beach; Ocala National Forest, Marion Co.; Orlando; Ortega. GEORGIA: Belleville; ?Savannah.

THE ALBOCOLLARIS GROUP

Melissodes (Epimelissodes) albocollaris Cockerell.

Melissodes albocollaris Cockerell, 1918, Trans. Amer. Ent. Soc., vol. 44, p. 30.

This species is known only from the males which can be recognized by the totally black clypeus and labrum and by the distinct punctures in the apical areas of metasomal terga 2 to 5. This punctation is coarser and less regular than the punctation in *M. atripes*.

Male. Measurements and ratios: N, 6; length 13-14 mm.; width, 4.5-5.5 mm.; wing length, M = 5.16 ± 0.387 mm.; hooks in hamulus, M = 15.00 ± 0.316; length of flagellar segment 2/segment 1, (N, 4) M = 3.27 ± 0.116.

Structure and color: Integument black, except last two tarsal segments which are rufescent; mandibles black except for a longitudinal golden spot over distal half; eyes black with violaceous reflections; tegulae black; wing membranes deeply infumate, veins dark reddish-black; antennal scapes black, flagella black above, reddish below on segments 2-11. Maximum length of first flagellar segment equals half or slightly more of minimum length of second segment; galeae slightly shagreened, but not enough to dull surface, almost twice as long as clypeus; clypeal width 1.5 times length or more; maxillary palpal segments in ratio of about 3:3:3:1, minute fifth segment sometimes present; eyes bulbous, converging slightly towards mandibles, narrowest facial width at level immediately below tentorial pits. Dorsal face of propodeum with coarse punctures, reticulorugose only anteriorly, if at all. Dorsal face of first metasomal tergum with round distinct punctures separated by one or more puncture widths in basal half, with smaller, more crowded punctures in distal half, ground spaces somewhat dulled by delicate shagreening, especially basally; terga 2-5 distinctly punctate in

area apical to lateral fasciae of white pubescence as well as basally, punctures separated by one or more puncture widths distally, by less basally, ground minutely shagreened, moderately shiny.

Gonostyli long, with sharply truncate apices, narrowest in basal third, apices about as wide as bases; spatha about 3 times as wide as long, with a median apical emargination. Lateral excavation of lateral plate of sternum 7 equals half length of lateral plate, or slightly less; median plate with few simple hairs near apex or none; anterior apodemes about equal to median length of sternum. Sternum 8 broadly emarginate distally, with rounded lateral apical angles; transverse ventral carina blunt, well separated from apex of sternum, weak; ventrally with one or two pairs of short stout hairs below middle of sternum of each side (Figs. 42-44).

Hair: Largely black and sparse; whitish on face and genal areas, but black on vertex and a few dark hairs on clypeus; whitish on pronotum, in a narrow band thinning laterally at anterior margin of mesoscutum, in a thin line immediately mesad of tegulae, on extreme posterior and lateral margins of scutellum, usually in a vertical band on anterior half or less of lateral faces of mesepisterna and on tegulae. Basal area of tergum 1 with long plumose hairs largely black medially and pale ochraceous to white laterally; terga 2-5 with oblique lateral fasciae of short sparse appressed white pubescence, usually connected medially on terga 4 and 5; terga 6 and 7 and sterna with black hairs, somewhat rufescent on tarsi; inner surfaces of basitarsi with bright rufescent to reddish-brown hairs.

Type material. Holotype male from Veracruz, Mexico, 1896, collected by H. Heyde (C. F. Baker collection), in the U. S. National Museum (U. S. N. M. Type No. 22,817).

Distribution. Central and eastern Mexico. Specimens examined in addition to the holotype are as follows:

Michoacan: Acahuato, altitude 3000 feet, August 19, 1941, Hoogstraal collector, 1 male. Puebla: Atlixco, 7 miles S., altitude 4000 feet, July 13, 1953, University of Kansas Mexican Expedition, 4 males.

the obliqua group

This is the largest group of North American *Epimelissodes*. The group consists of nine species and four subspecies. They can be readily separated from *atripes* and *albocollaris* by the characters described for the latter two species. They are distinguished from members of the *suffusa* group by the form of the pale pubescent

bands on terga 2 and 3. This pale pubescence is either restricted to oblique lateral fasciae or to more or less discrete bands which are well separated from the apical margins of the terga.

Female. Apical areas of terga 2 and 3 without distinct punctures, usually impunctate or with minute punctures obscured by dense shagreening. Hairs variable; pale pubescence on terga 2 and 3 restricted to lateral oblique fasciae which may meet at midline (especially on tergum 3); pale pubescence on terga 2 and 3, if not restricted to lateral fasciae, at least well separated from apical margins of terga; apical margins of terga 2 and 3 bare or with minute appressed hairs which are usually dark in color and which scarcely obscure the surfaces; in one form entire metasoma covered with dark brown to black hairs; scopal hairs pale, highly plumose.

Male. Clypeus, labrum and bases of mandibles always pale in color; punctation of terga as in female. Pale pubescent bands on terga 2-4 as in female, but usually in complete bands; tergum 2, and in one form the entire metasoma, occasionally without pale pubescence.

Gonostyli various, but never with sharply truncate apices; spatha about 3 times as wide as long, often with a slight median apical emargination. Sternum 7 with lateral excavation of lateral plate equal to about half of length of plate and often more. Sternum 8 without short stout hairs on ventral surface (Figs. 24-27).

Melissodes (Epimelissodes) grandissima Cockerell.

Melissodes grandissima Cockerell, 1905, Can. Ent., vol. 37, p. 334; 1906, Ann. Mag. Nat. Hist., ser. 7, vol. 17, p. 361; 1906, Trans. Amer. Ent. Soc., vol. 32, p. 88.

Melissodes atripes var. *acomanche* Cockerell, 1906, Trans. Amer. Ent. Soc., vol. 32, p. 109 (new synonymy).

This species can be separated from other members of the *obliqua* group by the characters summarized in the key. It is closely related to *aegis* and to *helianthelli* from which it is distinguished chiefly by the color of the hairs of the legs, terga and thorax. *M. grandissima* superficially resembles *comanche,* but can be easily separated from the latter on the basis of color and the punctation of the clypeus.

Female. Measurements and ratios: N, 20; length, 16-20 mm.; width, 5.5-8.0 mm.; wing length, $M = 6.15 \pm 0.796$ mm.; hooks in hamulus, $M = 19.90 \pm 0.886$; flagellar segment 1/segment 2, $M = 2.08 \pm 0.087$.

Structure and color: Integument generally black; distitarsi and occasionally apical sixth of clypeus and basal half of mandibles

rufescent; distal half of mandibles with a large golden macula almost as broad as mandible distally and tapering basally; tibial spurs dark red to reddish-brown; antennal scape and first two flagellar segments black, remaining segments usually rufescent on lower, outer surfaces; eyes usually yellowish-green; wing membranes moderately infumate, veins dark reddish-brown. Eyes bulbous, usually slightly shorter than width of face between upper inner angles of eyes; maxillary palpal segments in ratio of about 3.5:4:3:1.5, occasionally with minute fifth segment; at least median third of posterior half of clypeus with punctures separated mostly by one puncture width, ground areas tessellate; supraclypeal area with small punctures obscured by dense tessellation. Thorax densely punctate, ground dulled by shagreening; punctures of scutellum conspicuously smaller and denser than those of posteromedian area (in middle of patch of dark brown hairs) of mesoscutum; punctures of mesepisterna generally larger than those of mesoscutum and often confluent, with shagreened bottoms; dorsal face of propodeum reticulorugose laterally, with well-separated punctures in medial third. Basal half or less of first tergum with coarse punctures extending distally at extreme sides; terga 2 and 3 with areas basad of oblique pale fasciae (interband zone laterally) with minute punctures obscured by dense tessellation; apical areas of terga 1 to 3 dulled by dense shagreening.

Hair: Head with pale ochraceous to white hairs, becoming pale ferruginous on vertex, short hairs between lateral ocelli and apices of compound eyes dark red to brown. Pale hairs of thorax pale ferruginous; mesepisterna with ochraceous hairs; mesoscutal patch of dark hairs well separated from tegulae, rounded anteriorly, little or no larger than patch of dark hairs on scutellum; axillae with large tufts of brown hairs. Basal half of first tergum with long pale ochraceous hairs; tergum 2 with very narrow, oblique, lateral, pubescent fasciae often meeting medially; tergum 3 with pale pubescent band usually narrowly interrupted; tergum 4 with broad band of white pubescence interrupted medially usually by only a narrow stripe of dark brown pubescence and at most by a patch of dark pubescence less than one fourth as wide as tergum; tergum 5 usually without pale hairs at extreme sides; terga 2 and 3 with pale ochraceous appressed hairs laterally; sternal hairs dark brown to black. Distitarsi with reddish-brown to brown hairs; fore and middle basitarsi with dark brown hairs on outer surfaces; inner surfaces of basitarsi with dark reddish-brown to black hairs; fore and middle

tibiae and hind femora with brown to ochraceous hairs; scopal hairs mostly ochraceous to dark buff-colored, becoming brown on lower half of basitarsi and on basitibial plates.

Male. Measurements and ratios: N, 4; length, 16-20 mm.; width, about 6.0 mm.; wing length, M = 5.91 ± 0.595 mm.; hooks in hamulus, M = 19.25 ± 0.629; flagellar segment 2/segment 1, (N, 3) M = 2.97 ± 0.053.

Structure and color: With characters of color and punctation as in female; clypeus, labrum and bases of mandibles pale yellow to cream-colored; maxillary palpi as in female; minimum length of first flagellar segment equals about one third of maximum length of second segment, occasionally longer, but never as long as half of second segment.

Genitalia and hidden sterna similar to *M. obliqua.* Gonostyli usually more capitate than in *obliqua* and usually with longer and more abundant hairs. Sternum 7 much as in *obliqua,* with hairs on ventral surface below inner margin of emargination and with several long plumose hairs on dorsal surface mesad of lower half of heavily sclerotized lateral plates; lateral apodemes shorter than medial length of sternum. Sternum 8 with long apical hairs more clearly separated into medially stout and laterally fine hairs on each side than in *obliqua,* with or without hairs medially at apex; transverse carina well separated from apex and with or without short stout appressed hairs.

Hairs: Head and thorax as in female, but mesoscutal patch of brown hairs usually smaller; anterior and lower surfaces of mesepisterna with pads of dense, closely appressed, ochraceous hairs. First metasomal tergum with long pale hairs on basal half to three fifths; terga 3-5 with white pubescent bands more or less narrowly interrupted medially; terga 6 and 7 with dark hairs only; sternal hairs dark brown; holotype male of *M. acomanche* with considerably narrower fasciae on terga 2 to 4 than usual, fasciae well separated from pale lateral hairs on terga 2 and 3 and without pale pubescence on tergum 5 in this specimen. Hairs of legs ochraceous except ferruginous to brown on distitarsi, dark reddish-brown to black on inner surfaces of basitarsi and tibiae, and dark brown to black on outer surfaces of hind basitarsi (and often middle basitarsi as well).

Remarks. Cockerell in 1906 gave the name of *acomanche* to an especially dark male specimen. The reduced pale fasciae of the terga of this specimen and the dark hairs of the hind basitarsi led

Cockerell to consider it as a variety of *M. atripes*. Characters of punctation and of the genitalia and hidden sterna show that this male is conspecific with males associated with females of *M. grandissima*. *M. grandissima* may eventually be considered as a subspecies of *M. helianthelli* from which it is distinguished chiefly on the basis of color. Two females of *grandissima* from Glen Rose, Texas (the northwestern boundary of the range of this species as now known), are somewhat paler than usual, but are not pale enough to be considered as intergrades between *grandissima* and *helianthelli*. These two species are completely allopatric, as far as existing collections show, therefore, it is perhaps best to consider them as distinct species rather than subspecies until further collecting can conclusively resolve the problem. Another fact that appears to separate them is the difference in flight dates, *grandissima* apparently being principally a late season bee and *helianthelli* an early bee.

M. grandissima is also clearly related to *aegis*, but the evidence for considering these two species as being distinct rather than as subspecies is stronger than in the case of *grandissima* and *helianthelli*. This problem is discussed below under *M. aegis*.

In two of the four males studied, nematodes were found to be protruding from the external opening of the membranous penis. These were cleared, together with the genitalia, in lactophenol and, thus, gave the appearance of a fringe of membranous filaments at the tip of the penis. The penis of one specimen was tightly packed with these small worms.

Type material. Holotype female of *grandissima* from Fedor, Texas, collected by G. Birkmann, in the collection of the University of Colorado Museum, Boulder. Holotype male of *acomanche* from Fedor, Texas, June 11, 1896, G. Birkmann, property of the California Academy of Sciences, but on temporary loan to the Citrus Experiment Station, Riverside, California.

Distribution. Southeastern Texas. Specimens of *grandissima* have been collected from June 6 through November 6, but most often in September and October (Fig. 4). In addition to the type material 32 females and 4 males were examined from the localities listed below. One female specimen labeled "Camd. Co., N. J." from the W. J. Fox collection is presumably mislabeled.

Texas: Atascosa Co.; Austin; Bexar Co.; Corpus Christi; Fedor, Lee Co.; Frio Co.; Glen Rose (2.8 miles N.), Somervell Co.; Sommerset, Bexar Co.; Victoria.

Flower records. Both females and males have been collected on *Ximenesia encelioides.* A single female from Bexar Co., Texas, has the cryptic label "A. lig." which presumably refers to another flower.

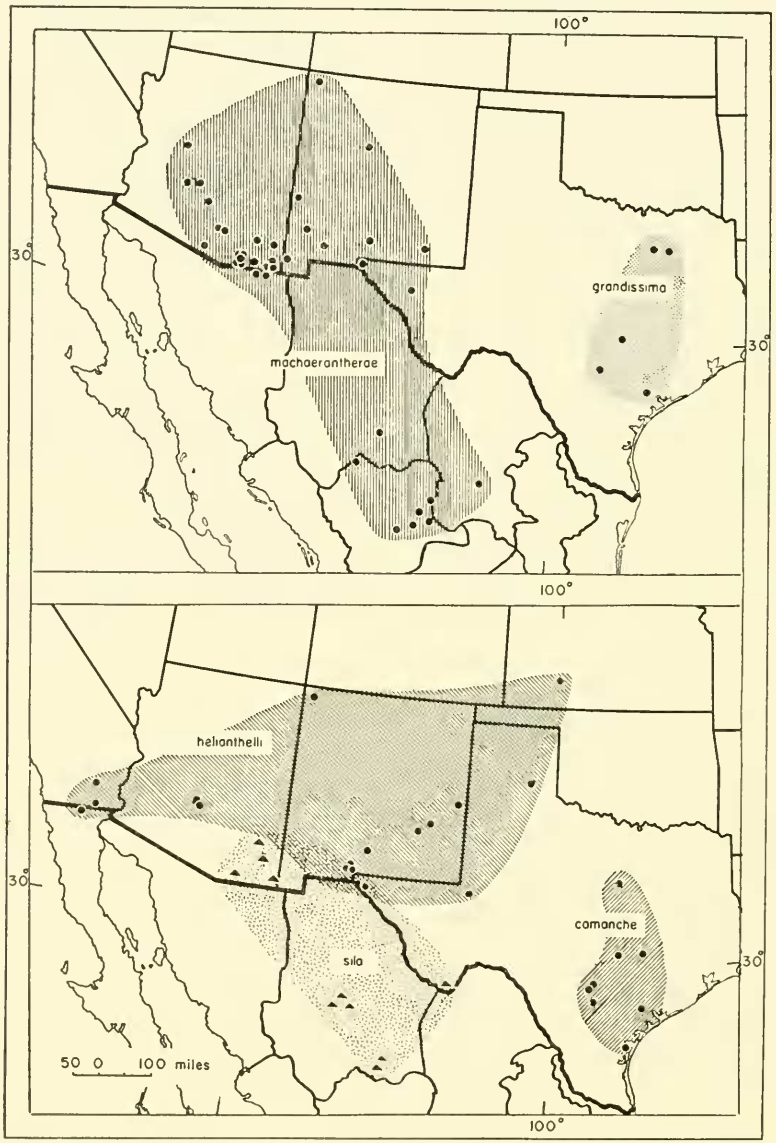

FIG. 4. Map showing the distribution of *M. (Epimelissodes) machaerantherae* and *M. (E.) grandissima* (above), and *M. (E.) comanche, M. (E.) helianthelli* and *M. (E.) sila* (below). Localities of *helianthelli* (dots) and *sila* (pyramids) can be distinguished by the different types of symbols.

Melissodes (Epimelissodes) aegis, sp. nov.

Melissodes texana, Michener, 1947, Amer. Mid. Nat., vol. 38, p. 453 (misidentification).

This species is closely related to *M. obliqua* and to *M. grandissima*. It is distinguished from *obliqua* by absence of dark brown hairs on the mesepisterna in the female and by having a dense pad of closely appressed hairs on the anterior surfaces of the mesepisterna in the male. *M. aegis* can be separated from *grandissima* chiefly on the basis of color and average size, as summarized in the key.

Female. Measurements and ratios: N, 20; length, 14-18 mm.; width, 5.0-6.5 mm.; wing length, M = 5.86 ± 0.446 mm.; hooks in hamulus, M = 18.65 ± 0.357; flagellar segment 1/segment 2, M = 2.09 ± 0.026.

Structure and color: Anterior margin of clypeus and distitarsi rufescent; bases of mandibles and labrum more often translucent yellow or orange than in *grandissima;* eyes usually bluish-gray, occasionally bluish-green. Length of eyes generally equal to or slightly more than width of face at upper inner angles of eyes; maxillary palpi as in *grandissima.* Sculpturing in detail much as in *grandissima*; punctures of scutellum about equal in size to those in middle of dark mesoscutellar hair patch; propodeum with upper impunctate triangular area smaller than in *grandissima,* often entire declivous face punctate.

Hair: Head as in *grandissima,* but often with at least a few long dark brown hairs on vertex in addition to the short brown hairs between lateral ocelli and apices of compound eyes. Mesoscutal patch of dark brown hairs with a relatively straight anterior margin, narrowly separated from tegulae and usually considerably larger than the scutellar dark patch, otherwise hairs of thorax as in *grandissima.* Hairs of metasoma much as in *grandissima* but oblique lateral fasciae of tergum 2 usually wider, basal area of long ochraceous hairs on tergum 1 slightly narrower than the apical area, dark patch of brown pubescence on tergum 4 at least as wide as one fourth of tergum and usually much wider, sternal hairs dark reddish-brown to red and usually with a tuft of paler hairs laterally on tergum 5. Hairs of legs ochraceous except dark brown hairs of fore tarsi, ferruginous hairs of inner surfaces of middle and hind tarsi and hind tibiae and brown hairs on basitibial plates; scopal hairs on outer surfaces of hind basitarsi ochraceous, not largely black or brown as in *grandissima.*

Male. Measurements and ratios: N, 20; length, 13-17 mm.; width, 4.5-6.5 mm.; wing length, M = 5.19 ± 0.298 mm.; hooks in hamulus, M = 16.10 ± 0.228; flagellar segment 2/segment 1, M = 2.96 ± 0.043.

Structure and color: Punctation, integumental color, maxillary palpi and flagellar segments as in *grandissima.*

Genitalia as in *obliqua,* gonostyli more distinctly capitate and thinner medially. Sternum 7 as in *obliqua,* but without short hairs on ventral surfaces near lower margin of apical emargination and sometimes with a few long plumose hairs on dorsal surface mesad to lower half of lateral plate as in *grandissima.* Sternum 8 as in *obliqua* and *grandissima,* but lateral apodemes directed somewhat anteriorly and ventral transverse carina very blunt so that it forms a bilobed ventral eminence rather than a distinct bidentate carina.

Hair: As in *grandissima* with the following differences: mesoscutal patch of brown hairs somewhat larger and white pubescent fasciae and bands on terga usually wider; legs with paler hairs than *grandissima,* ochraceous except for hairs of inner surfaces of tarsi which are ferruginous (often reddish-brown to brown on inner surfaces of hind basitarsi) to yellow.

Remarks. This species is exceedingly close to *grandissima.* Both sexes of *aegis* average smaller than those of *grandissima* and there are a few average structural differences described above; however, a combination of color characters serves to definitely distinguish the two species. Considering the large amount of geographic variation in regard to color existing in other species of *Epimelissodes,* it appears that *aegis* and *grandissima,* which are largely allopatric, might be subspecies of one species. However, the color changes from east to west in these two forms do not present a cline of any sort and one species is not consistently darker than the other in all characters. For instance, *aegis* is darker than *grandissima* in the patch of brown pubescence on the fourth tergum, in the mesoscutal patch of dark hairs and in the brown hairs of the vertex of the head. However, *grandissima* has darker legs and darker hairs on the metasomal sterna and on the last two terga than *aegis.* At least three typical females of *aegis* have been collected in eastern Texas well within the range of *grandissima.* For these reasons *M. aegis* and *M. grandissima* are considered as close, but distinct, species.

Type material. Holotype male, allotype female, 2 male paratypes and 2 female paratypes from one mile north of Citronelle, Ala-

bama, August 21, 1952, on *Helenium tenuifolium* (L. H. Shinners). Seven additional male and twelve female paratypes as follows: Alabama: Cowarts, August 1-3, 1916, 2 females; Mobile, July 15, 1909, 1 male. Florida: Branford, July 31, 1930, 2 males, 1 female; Monticello, October 4-8, 1914, 1 male; Gainesville, August 17, 1931, 1 male. Mississippi: Hattiesburg, September 26, 1943, 2 females, September 12, 1943, 1 female, September 17, 1944, 1 female, September 24, 1944, 1 female, October 1, 1944, 1 female; Camp Shelby near Hattiesburg, September 17, 1944, 3 females. The holotype and allotype are in the Snow Entomological Museum at the University of Kansas. Paratypes are in the Snow Entomological Museum, the American Museum of Natural History, the U. S. National Museum, the T. B. Mitchell collection at the North Carolina College of Agriculture and Engineering and in the author's collection.

Distribution. Eastern Texas through the Gulf States to Florida and north to North Carolina (Fig. 8). These bees have been collected from July 10 through October 14. In addition to the type material listed above, a total of 40 females and 20 males have been examined from the following list of localities.

Alabama: labeled "Alab.". Florida: Blountstown; Pensacola; Yankeetown. Georgia: Adel; Bainbridge; Butler's Ferry, Decatur Co.; Cordele, Decatur Co.; Spring Creek, Decatur Co.; Thomasville; Vidalia. North Carolina: Cape Fear River (mouth of); Southern Pines; Tarheel. South Carolina: St. Mathews; Summerville; Sumter. Texas: College Station, Brazos Co.; Houston; Lee Co.

Flower records. Aster sp., *A. pruinosa, Gaillardia* sp., *Helenium tenuifolium, Helianthus* sp., *H. annuus, H. radula, Vernonia glauca.*

Melissodes (Epimelissodes) comanche Cresson.

Melissodes comanche Cresson, 1872, Trans. Amer. Ent. Soc., vol. 4, p. 276; 1875, *in* Wheeler, Report upon geographical and geological explorations and surveys west of the one hundredth meridian, vol. 5, p. 726; Birkmann, 1899, Ent. News, vol. 10, p. 245; Cockerell, 1906, Trans. Amer. Ent. Soc., vol, 32, pp. 78, 83, 89; Cresson, 1916, Mem. Amer. Ent. Soc., vol. 1, p. 115.

This species resembles *grandissima* and *aegis*, but can be separated from these by the much denser and finer punctation on the clypeus. It is distinguished from *obliqua* by the same character, by lacking dark hairs on the mesepisterna in the female and by having a pad of dense appressed hairs on the anterior surfaces of the mesepisterna in the male. *M. comanche* also resembles *helianthelli* closely, but is darker and has more distint punctures

in the narrow area anterior to the oblique lateral fasciae on tergum 2.

Female. Measurements and ratios: N, 9; length, 17-20 mm.; width, 6-7 mm.; wing length, M = 6.32 ± 0.344 mm.; hooks in hamulus, M = 20.89 ± 0.485; flagellar segment 1/segment 2, M = 2.40 ± 0.047.

Structure and color: Integument generally black; legs, apical areas of terga and sterna usually rufescent; apical margin of clypeus and bases of mandibles occasionally rufescent; mandibles with a wide median golden macula over apical half or slightly less; scape, pedicle and first two flagellar segments dark brown to rufescent, remaining flagellar segments reddish-yellow below and dark reddish-brown above; tibial spurs pale red to yellow; wing membranes moderately infumate, veins dark red; tegulae translucent brown. Clypeus finely and densely punctate, ground areas reduced to ridges equal to half a puncture width, densely shagreened; supraclypeal area with abundant coarse punctures distinctly larger than those on clypeus, moderately shiny; maxillary palpi as in *aegis;* eyes in facial view about one-third as wide as long or slightly wider, not bulbous as in *aegis* and *grandissima,* about equal in length to facial width between inner upper angles of eyes; first flagellar segment generally slightly longer than wide on ventral surfaces, never broader than long. Punctation on mesoscutum and scutellum coarse and dense, punctures rarely separated by as much as half a puncture width, ground shagreened, moderately shiny; dorsal face of propodeum reticulorugose, declivous face densely punctate, dorsal impunctate area of declivous face small and oval. Anterior punctate area of tergum 1 equal to about half of length of tergum medially; terga 2-4 in areas basad of pale pubescent bands or fasciae and beneath these pubescent areas (interband zone of tergum 2) with distinct deep punctures separated by less than one puncture width; apical areas of terga 1-3 with minute shallow punctures obscured by shagreening, moderately shiny.

Hair: Long, mostly erect on dorsum of thorax; color much as in *aegis,* but with the following differences: no dark brown hairs on vertex of head; oblique lateral fasciae on terga 2 and 3 well separated medially; dark median patch of brown pubescence on tergum 4 equals about one fourth of width of tergum, rarely more; hairs of sterna usually brown; hairs of inner surfaces of hind basitarsi reddish-orange to yellow.

Male. Measurements and ratios: N, 11; length, 16-19 mm.;

width, 5-7 mm.; wing length, M = 6.00 ± 0.458 mm.; hooks in hamulus, M = 18.64 ± 0.388; flagellar segment 1/segment 2, M = 2.27 ± 0.018.

Structure and color: Color as in female except clypeus and bases of mandibles yellow and labrum whitish; flagellum mostly reddish-orange except reddish-brown first segment and reddish-brown dorsal stripe on remaining segments. Punctation as in female, but clypeus appears less punctate; eyes bulbous, less than 3 times as long as broad; minimum length of first flagellar segment equals half or more of maximum length of second segment, occasionally less, but never as short as one third of second segment (ratio in allotype male equals about 9.0:21.5).

Genitalia and hidden sterna similar to those of *machaerantherae*. Gonostyli strongly S-shaped, thinnest about one third of distance from base, thickest at base; spatha gently and broadly emarginate, bidentate on lower angle of piceous lateral process. Sternum 7 as in *machaerantherae* but hairs on medial plates fewer and finer. Sternum 8 as in *machaerantherae* but lateral apodemes directed less anteriorly, without thick median apical hairs and apical lateral hairs longer, fewer and thinner.

Hair: Much as in *aegis*, but with the following differences: hairs generally longer and weaker; mesonotal patch of brown hairs often reduced to a few hairs; metasoma darker, pale pubescent fasciae thin, usually forming complete bands, without pale hairs at extreme sides of tergum 3 and usually not on tergum 2, tergum 5 usually without pale pubescence, sternal hairs dark brown, inner surfaces of hind basitarsi with orange to yellow hairs.

Remarks. The closest relative of *comanche* is *machaerantherae*, as shown by the generally longer hairs and by the similarity of the male genitalia and hidden sterna. The two forms, as far as is known at present, are sympatric over a large area of New Mexico, if specimens of *comanche* from New Mexico and Colorado were correctly identified by Cresson (1875). Even if proved to be completely allopatric, the difference in punctation of clypeus and metasoma are such that I would not hesitate in regarding them as distinct species.

Type material. Lectotype female, lectoallotype male and four female paratypes from Texas are in the Academy of Natural Sciences of Philadelphia.

Distribution. Eastern Texas and, perhaps, west to New Mexico and Colorado (Fig. 4). This species has been taken from July 19

to Nov. 2. In addition to the type material, 13 females and 12 males were examined from localities listed below (this list includes published records).

TEXAS: Austin; Bexar Co.; Dallas; Terrell; Victoria; Waco. NEW MEXICO and COLORADO: two females not examined by the author but reported by Cresson (1875) as collected in these states by Dr. H. C. Yarrow.

Flower records. Males have been collected on flowers of *Ximenesia encelioides.* No flower records exist for the females.

Melissodes (Epimelissodes) machaerantherae Cockerell.

Melissodes machaerantherae Cockerell, 1904, Ann. Mag. Nat. Hist., ser. 7, vol. 14, p. 21; 1906, Trans. Amer. Ent. Soc., vol. 32, p. 90; 1906, Trans. Amer. Ent. Soc., vol. 32, p. 310.

M. machaerantherae is similar to *helianthelli* in color, being perhaps slightly paler, but can be separated easily from the latter by its longer hair and pubescence and by the punctation of the clypeus and supraclypeal area, as described below. Furthermore, the males of these two species can be easily separated by the longer first flagellar segment in *machaerantherae.* The closest relative of this species is *M. comanche,* from which it is distinguished by its less punctate metasomal terga and by its paler coloration.

Female. Measurements and ratios: N, 20; length, 15-17 mm.; width, 6-7 mm.; wing length, $M = 6.13 \pm 0.397$ mm.; hooks in hamulus, $M = 19.65 \pm 0.372$; flagellar segment 1/segment 2, $M = 2.38 \pm 0.098$.

Structure and color: Integument generally black; tarsi, occasionally tibiae and rarely femora rufescent; sterna and occasionally apical areas of terga rufescent; apical half or more of mandibles with elongate golden maculae; eyes usually pale greenish to yellowish-brown; antennae wholly black, flagella occasionally somewhat reddened beneath; wing membranes yellowish, scarcely infumate, veins dark red to reddish-brown; tegulae testaceous. Clypeus densely punctate as in *comanche,* but median third of posterior half with punctures larger and shallower than in *comanche,* often confluent, ground and bottoms of punctures dulled by coarse tessellation; supraclypeal area with large round deep punctures as in *comanche,* ground shagreened, moderately shiny; first flagellar segment about as long as broad ventrally; maxillary palpal segments in ratio of about 3:3:3:1, third segment sometimes longer. Mesoscutal and scutellar punctures coarse, about equal in size, separated mostly by half or less of one puncture width, ground on meso-

scutum dulled by tessellation, on scutellum lightly shagreened but scarsely dulled; lateral faces of mesepisterna with sculpturing as on mesoscutum; dorsal face of propodeum reticulorugose at extreme base, with distinct punctures over apical two thirds, coarsely tessellate, impunctate dorsomedial area of declivous face small, oval. First tergum with basal half densely punctate, punctures small shallow and extending nearly to margin of tergum laterally, entire surface dulled by fine shagreening; tergum 2 with only a few scattered punctures in interband zone laterally, these punctures large and separated by variable length but mostly by two puncture widths or more, entire tergum dulled by dense shagreening which is reticular in basal area; terga 3 and 4 similar to tergum 2.

Hair: Generally paler than in *comanche* and similar to *helianthelli*; hairs and pubescence generally long and weak, prone to be rubbed off or matted; head and thorax generally with pale ochraceous hairs tending to be paler on head, episterna and propodeum, and rufescent on anterior half of mesoscutum; scutellum with distinct patch of brown hairs; mesoscutum with at most several brown hairs in posteromedian area and usually none. Long hairs in basal area of tergum 1 pale ochraceous; terga 2, 3 and 4 usually with complete pale ochraceous bands, rarely extremely narrowly interrupted on tergum 2, pale ochraceous, but tending to be white especially on tergum 4; hairs composing pale pubescent fasciae long and weak, those on tergum 2 confluent with basal pale band of spatuloplumose hairs, the latter not sharply delimited posteriorly as in other species of this group; terga 5 and 6 with long appressed pale ochraceous hairs laterally, tending to be rufescent and occasionally pale brown medially; apical areas of terga 1-3 with short appressed hairs usually dark brown; sternal hairs orange to ochraceous, becoming pale ochraceous to white laterally. Legs with pale ochraceous hairs except reddish-brown on fore tarsi and orange to yellow on inner surfaces of middle and hind basitarsi; scopal hairs pale ochraceous to white.

Male. Measurements and ratios: N, 20; length, 11-16 mm.; width, 4.0-6.5 mm.; wing length, $M = 5.59 \pm 1.014$ mm.; hooks in hamulus, $M = 17.05 \pm 0.373$; flagellar segment 2/segment 1, $M = 2.37 \pm 0.097$.

Structure and color: Integumental color as in female except clypeus, bases of mandibles and labrum cream-colored; eyes yellowish-brown to slightly greenish; antennae usually wholly black, flagella occasionally dark reddish-brown beneath; wing membranes

faintly infumate apically, yellowish, veins red to reddish-brown. Sculpturing as in female, but usually more than half of tergum 1 with dense punctation; minimum length of first flagellar segment equal to half of maximum length of second segment and usually slightly more, occasionally slightly shorter, but never as short as one third of second segment; maxillary palpi as in female, but occasionally a minute fifth segment present.

Genitalia and hidden sterna similar to those of *M. comanche*. Gonostyli thinnest about one third of distance from base, distinctly S-shaped, thickest at base; spatha bidentate on lower angle of lateral process, not emarginate apically. Sternum 7 with lateral apodemes slightly longer than median length of sternum; hairs of median plates thick and simple. Sternum 8 with lateral apodemes directed anteriorly; apical emargination with 1-3 median hairs slightly barbed near tips and much thicker than lateral apical hairs which are relatively thin and almost all simple (Figs. 51-54).

Hair: Much as in female, but with the following differences: head usually with almost wholly white hairs; scutellum with only a few brown hairs; mesoscutum without brown hairs; tergum 3 with pale pubescent band as wide as or wider than apical area medially, unless rubbed off; last two metasomal terga with pale ochraceous hairs only; sternal hairs mostly pale ochraceous, somewhat rufescent medially and apically; legs with pale ochraceous hairs, except for orange to yellow hairs on inner surfaces of tarsi and hind tibiae. In what seemed to be newly emerged specimens all hairs and pubescence may be somewhat rufescent.

Type material. Holotype male from White Sands, New Mexico, September 30, T. D. A. Cockerell, property of the California Academy of Sciences, temporarily deposited in the collections of the Citrus Experiment Station, Riverside, California.

Distribution. Arizona eastward to extreme southwestern Texas and south through Sonora, Chihuahua and western Coahuila to southern Durango in Mexico (Fig. 4). These bees have been collected from July 10 to November 1, but mostly in the latter part of August and September. In addition to the holotype, 41 females and 59 males have been examined from the localities listed below (this list includes localities referred to in the literature).

ARIZONA: Baboquivari Mts.; Bisbee (12 and 18 miles W.); Buckeye, Mariposa Co.; Carr Canyon (Huachuca Mts.); Chiricahua Mts., Cochise Co.; Douglas; Huachuca Mts.; Kirkland, Yavapai Co.; Lee Siding (Pedregosa Mts.), Cochise Co.; Phoenix;

Pima Co.; Ramsey Canyon (Huachuca Mts.); Sacaton; San Bernardino Ranch, Cochise Co.; Sonoita (10 miles E.); Tucson; Turner; Willcox. New Mexico: Alma, Catron Co.; Albuquerque; Carlsbad (5 miles W.); Deming; Mule Creek, Grant Co.; Rodeo, Hidalgo Co.; Shiprock; White Sands. Texas: El Paso. Chihuahua: Jiménez (10 miles W.). Coahuila: Paila. Durango: Canutillo (8 miles S.); La Loma; Nombre de Dios; Pedriceña; Yerbanís, Cuencamé District. Sonora: Naco; Aqua Prieta.

Flower records. The holotype male and one male paratype were collected on *Machaeranthera* (= *Aster*) and one male paratype on *Cucurbita palmata.* Additional males have been taken on *Asclepias* sp., *Helianthus* sp., *H. annuus, Verbesina* sp., and *V. encelioides.* Females have been collected on *Helianthus* sp. and on *Wislizenia refracta.*

Melissodes (Epimelissodes) helianthelli Cockerell.

Melissodes helianthelli Cockerell, 1905, Ann. Mag. Nat. Hist., ser. 7, vol. 15, pp. 525-526; 1906, Trans. Amer. Ent. Soc., vol. 32, p. 89; 1906, Trans. Amer. Ent. Soc., vol. 32, p. 310.
Melissodes comanche, Stroud, 1947, Amer. Mid. Nat., vol. 44, p. 673 (misidentification).

M. helianthelli superficially resembles *machaerantherae* closely, but it can be easily separated from the latter on the basis of the male genitalia, relative lengths of the first two flagellar segments of the male, sculpturing of the supraclypeal area in both sexes and sculpturing of the clypeus in the female. These differences are described below and summarized in the key. The closest relative of *helianthelli* is *grandissima.* These two species are distinguished chiefly on the basis of color, *helianthelli* being paler than *grandissima.* The male of *helianthelli* can be easily confused with the male of *M. obliqua expurgata,* but the male of *helianthelli* has a pad of closely appressed hairs on the lower half of the anterior face of each mesepisternum which is absent in *obliqua.*

Female. Measurements and ratios: N, 11; length, 16-18 mm.; width, 6-7 mm.; wing length, M = 6.31 ± 0.319 mm.; hooks in hamulus, M = 20.09 ± 0.436; flagellar segment 1/segment 2, M = 2.10 ± 0.021.

Structure and color: Legs and apical areas of metasomal terga 1 to 3 often rufescent; scape, margin of clypeus and bases of mandibles often rufescent or yellowish; flagella usually dark brown to black, only slightly paler beneath; wing membranes scarcely infumate, veins reddish-brown to red. In structure and punctation identical with *M. grandissima.*

Hair: Color generally as in *grandissima,* but much paler; hairs on tegulae pale; mesoscutal patch of dark brown hairs usually absent, or very small; axillae without brown hairs. Metasomal tergum 2 with pale oblique fasciae meeting medially, or almost so, short hairs in area anterior to pale fasciae and posterior to basal band of spatuloplumose hairs pale ochraceous to pale brown; tergum 3 with broad pale pubescent band, as wide as or wider than apical area medially; tergum 4 with pale band never interrupted medially by dark brown pubescence; terga 5 and 6 with tufts of ochraceous hairs laterally; terga 3 and 4 with dense basal tomentum (usually partially or wholly hidden under apices of preceding terga) usually dark brown, occasionally that on tergum 3 pale rufescent as in the holotype; hairs of sterna pale brown to ochraceous, usually orange-red. Hairs of legs ochraceous except on inner surfaces of basitarsi red to orange, on outer surfaces of fore and occasionally middle basitarsi brown and on basitibial plates and distitarsi rufescent; scopal hairs entirely pale and highly plumose.

Male. Measurements and ratios: N, 15; length, 14-18 mm.; width, 5-6 mm.; wing length, $M = 5.74 \pm 0.445$ mm.; hooks in hamulus, $M = 17.40 \pm 0.966$; flagellar segment 2/segment 1, $M = 2.04 \pm 0.367$.

Structure and color: Color of integument as in *grandissima,* but flagella usually entirely dark, black above and black or dark reddish-brown beneath. Structure and punctation as in *grandissima;* minimum length of first flagellar segment usually longer than one third and always less than one half of maximum length of second segment.

Genitalia and hidden sterna much as in *grandissima.* Sternum 7 as in *obliqua,* with few short hairs on ventral surface below inner margin of emargination, without, or with only one or two, long hairs on dorsal surface mesad of lower half of dark, piceous lateral plates.

Hair: Generally as in *grandissima,* but much paler; mesocutum without dark brown hair patch, but a few dark hairs may be present; scutellar patch of dark hairs small or absent; axillae without brown hairs. Terga 2-5 with pale bands complete, broad, that on tergum 3 wider than apical area medially, that on tergum 2 with pale hairs between it and the basal spatuloplumose band; sternal hairs usually brown medially and pale laterally. Legs with pale ochraceous hairs except those on inner surfaces of tarsi bright red to yellow, but often brown on hind basitarsi; distitarsi usually with rufescent hairs.

Type material. Holotype female from Mesilla, New Mexico, June 26, T. D. A. Cockerell, property of the California Academy of Sciences, temporarily deposited in the collections of the Citrus Experiment Station, Riverside, California.

Distribution. Extreme western Texas north to southwestern Kansas, west across New Mexico and Arizona to extreme southern California and northern Baja California (Fig. 4). This species has been collected from June 26 to September 21, the majority in July and August. Including the holotype, 2 females and 16 males have been examined from the following localities.

Arizona: Phoenix; Tempe. Baja California: Mexicali (35 miles W.); one female labeled "Districto Federal, Baja California." California: Calexico, Imperial Co. (8 miles N.); Westmoreland. Kansas: Dodge City. New Mexico: Acme; Mesilla; Mesilla Park; Mesquite; Portales; Roswell; Shiprock; White Sands National Monument. Texas: Clarendon; El Paso; Metz.

Flower records. Both sexes have been taken on *Helianthus* sp. and on *Helianthus ciliarus.*

Melissodes (Epimelissodes) nitida, sp. nov.

This species, known only from Mexico, is closely related to *M. obliqua.* The males of *nitida* can be distinguished from the latter by the dark posterior margin of the otherwise lemon-yellow clypeus, by the markedly oblique fasciae which are interrupted medially on terga 2-5, by the smaller size and by the pale red to yellow hairs on the inner surfaces of the hind basitarsi. The males can be easily distinguished from most of the remaining species of the *obliqua* group by the lack of a dense pad of appressed hairs on the anterior face of each mesepisternum. The females differ from those of *obliqua* by having only pale hairs on the sides of the thorax and by having a more densely punctate clypeus and/or by the color combination as described below and summarized in the key.

Female. Measurements and ratios: N, 2; length, 14 mm.; width, 5 mm.; wing length, 4.63 mm.; hooks in hamulus, 15-16; flagellar segment 2/segment 1, 1.22.

Structure and color: Integument black; distitarsi and under surfaces of flagella rufescent; mandibles with large median golden maculae in apical halves or thirds; eyes grayish-brown; wing membranes slightly infumate, brownish, veins dark brown to black. Sculpturing as in *obliqua* with the following differences: clypeus with regular small crowded punctures separated by less than one

puncture width and mostly by about half of one puncture width posteromedially; supraclypeal area with small round deep punctures separated by less than one puncture width. Punctation of thorax coarse and crowded, ground surfaces shiny, unshagreened or only slightly so, except metanotum which is dulled by dense tessellation; propodeum densely punctate, ground opaque, dulled by dense tessellation. Tergum 2 with interband zone with small shallow punctures separated by one puncture width or slightly less laterally and becoming shallower, less distinct and sparser medially.

Hair: Pattern and color very much as in *texana*, but with the following differences: vertex with long hairs ferruginous, with abundant short dark brown hairs between apices of compound eyes and a few long brown hairs posterior to these. Mesoscutum with pale hairs ferruginous, with dark brown posteromedian hair patch small, oval, within the parapsidal lines anterolaterally and not extending forward to a transverse line at anterior margins of tegulae medially; scutellum with abundant dark brown hairs, fringed with ochraceous hairs; propodeum and sides of thorax with hairs pale ochraceous to ochraceous. Mesosoma with vestiture essentially as in *M. texana texana*, but apical areas of terga 2 and 3 with minute, dark brown, closely appressed, simple hairs much more abundant and tergum 3 with apical area broader, as broad medially as apical pale band of tergum 4 or broader; tergum 4 without brown hairs medially near apex, or with only a few. Legs with ochraceous hairs except as follows: inner surfaces of tarsi and hind tibiae yellow to orange; scopal hairs yellowish-white.

Male. Measurements and ratios: N, 6; length, 11-13 mm.; width, 4-5 mm.; wing length, $M = 4.09 \pm 0.211$ mm.; hooks in hamulus, $M = 14.00 \pm 0.516$; flagellar segment 2/segment 1, $M = 2.57 \pm 0.515$.

Structure and color: Integument generally black; distitarsi and apices of basitarsi rufescent; labrum white; mandibles with large lemon-yellow basal triangles and with elongate golden maculae over apical halves or slightly less; clypeus lemon-yellow except for black notches at anterior tentorial pits and narrow, black, irregular area at posterior margin between anterior tentorial pits; eyes yellowish-brown; antennae black except for dark reddish-brown ventral surfaces of flagella. Clypeus coarsely punctate and tessellate with larger punctures than in *obliqua*, but this obscured by color; supraclypeal area with large deep abundant punctures, ground dulled by tessellation; minimum length of first flagellar segment equals

one third or slightly more of maximum length of second segment; maxillary palpal segments in ratio of about 3:3:3:1, fourth segment being quite variable; eyes bulbous, but not so much as in *aegis,* somewhat less than 3 times as long as wide. Mesoscutum coarsely punctate with large deep round punctures separated mostly by less than one puncture width, ground shiny, very slightly shagreened; scutellum similar, punctures about same size as on mesoscutum; lateral faces of mesepisterna similar, punctures larger and more crowded than on mesoscutum; basal face of propodeum with large punctures, becoming crowded at extreme base so as to appear reticulorugose, ground with extremely coarse tessellation. Basal half to three fifths of first tergum coarsely punctate, punctures extending almost to margin laterally, ground dulled by dense shagreening; terga 2-3 with punctures separated mostly by one puncture width in small interband zone laterally, with minute, very shallow, inconspicuous punctures in apical areas, ground dulled by dense shagreening.

Gonostyli somewhat more slender, with rather sparse hairs which are much shorter than in *obliqua;* spatha distinctly emarginate apically. Sternum 7 shaped as in *obliqua,* but with only a few hairs on median plates and no short hairs on ventral surfaces below median emargination. Sternum 8 as in *obliqua,* but median apical emargination sharper and with only 5 or 6 stout hairs on either side and several smaller hairs laterad to these; with no or only one small apical hair arising just above median emargination; lateral apodemes directed somewhat anteriorly (Figs. 45-47).

Hair: Head and thorax with rather long, weak hairs; head with pale ochraceous to almost white hairs, becoming rufescent on vertex and with short brown or reddish-brown hairs between lateral ocelli and eyes. Thorax with bright rufescent or orange hairs above, except patch of dark brown hairs on scutellum and occasionally a few dark hairs near posterior margin of mesoscutum; sides of thorax and propodeum with pale ochraceous hairs, becoming paler below. Basal area of tergum 1, spatuloplumose band of tergum 2 and extreme sides of terga 2 and 3 with pale ochraceous hairs; terga 2 to 5 with oblique lateral fasciae of pale ochraceous to white pubescence; tergum 6 with a few pale hairs at extreme sides, otherwise with long dark brown hairs as in tergum 7; apical areas of terga 2 to 4 with closely appressed, dark brown hairs, considerably longer than comparable hairs in any other species of the *obliqua* group, but not so long or abundant as to hide surfaces; sterna with brown hairs

medially, especially on apical sterna, and pale hairs laterally. Legs with pale ochraceous to white hairs except bright orange to yellow hairs on inner surfaces of basitarsi.

Type material. Holotype male from 4 miles east of Tapanatepec, Oaxaca, Mexico, 700 feet altitude, July 9, 1953 (Univ. of Kansas Mexican Expedition). Allotype and one paratype female from Puente Grande, Jalisco, Mexico, 5000 feet altitude, August 20, 1954 (Univ. of Kansas Mexican Expedition). One male paratype from 7 miles northeast of Tapanatepec, Oaxaca, Mexico, 1300 feet altitude, July 9, 1953 (Univ. of Kansas Mexican Expedition); three male paratypes from Villa Guadalupe, Jalisco, Mexico, July 26, 1951, on *Asclepias* (P. D. Hurd); one male paratype from San Juan de los Lagos, Jalisco, Mexico, July 27, 1951, on *Eysenhardtia polystachya* (H. E. Evans). The holotype and allotype are in the Snow Entomological Museum at the University of Kansas. Paratypes are in the collection at the University of California, Berkeley, California, in the Snow Entomological Museum and in the author's collection.

Melissodes (Epimelissodes) obliqua (Say).

This species is highly variable in color; nonetheless, females are easily separated from all other species of this group by having black or dark brown hairs on at least the lower third of the lateral surface of each mesepisternum. The males are recognized through the lack of a dense pad of closely appressed hairs on the anterior surfaces of each mesepisternum and by having dark brown to black hairs on the hind basitarsi. Other characters of punctation, structure and color are useful in recognizing *obliqua* and these are summarized in the key and described below.

Female. Measurements and ratios: N, 20; length, 13-19 mm.; width, 5.5-7.5 mm.; wing length, $M = 5.57 \pm 0.398$ mm.; hooks in hamulus, $M = 18.25 \pm 0.298$; flagellar segment 1/segment 2, $M = 2.15 \pm 0.025$.

Structure and color: Integument generally black; distitarsi usually rufescent; margin of clypeus and bases of mandibles occasionally rufescent; mandibles with large golden maculae over distal halves; antennal scapes usually black, occasionally red, first two flagellar segments and dorsal surfaces of remaining segments dark brown to black, ventral surfaces of segments 3-12 paler, orange to dark red; eyes greenish-gray to purplish-black; wing membranes infumate, clear brown to dark brown with metallic reflections,

veins dark brown to black. Second flagellar segment usually slightly but distinctly shorter than broad ventrally, rarely as long as broad; clypeus with small round punctures usually separated in median third of posterior half by half of one puncture width, ground dulled by dense tessellation; supraclypeal area with abundant small round punctures about the diameter of those on clypeus or smaller, ground dulled by dense tessellation; eyes more than one third as wide as long in facial view; maxillary palpal segments in ratio of about 3:3:3:1, second segment often longer. Mesoscutum with coarse punctures separated mostly by half of one puncture width or less, ground shiny, slightly shagreened; scutellum with distinctly smaller, more crowded punctures than those in middle of mesoscutal dark hair patch, ground shiny; lateral faces of mesepisterna coarsely punctate, punctures larger and shallower than those on mesoscutum, often confluent, ground shiny, rarely shagreened, but bottoms of punctures usually somewhat dulled; dorsal face of propodeum reticulopunctate to punctate with very coarse punctures, declivous face usually with large impunctate median triangle, ground coarsely tessellate. Basal half or less of tergum 1 with coarse punctures which extend almost to apical margin of tergum laterally; tergum 2 with small shallow punctures obscured by dense shagreening in lateral raised areas of interband zone (or in comparable position when distal pale band or fasciae are lacking); apical areas of terga 1-3 with extremely minute punctures obscured by dense shagreening, these punctures scarcely visible except under high magnification.

Hair: Color extremely variable; mesepisterna always with considerable black or dark brown hair on at least posteroventral third of lateral surfaces and ventrally; anterior faces of mesepisterna with dark hairs and pubescence, which scarcely or not at all hides the surface; apical areas of terga 1-3 with extremely short, closely appressed, dark brown to black, simple hairs, but some pale hairs often present at sides; scopal hairs pale ochraceous to yellow, occasionally brown on lower halves of basitarsi; inner surfaces of hind basitarsi with dark brown to bright ferruginous hairs; basitibial plates with brown hairs. Additional color characters are described below under each subspecies.

Male. Measurements and ratios: N, 20; length, 12-18 mm.; width, 4.5-6.5 mm.; wing length, $M = 5.22 \pm 0.468$ mm.; hooks in hamulus, $M = 15.75 \pm 0.025$; flagellar segment 2/segment 1, $M = 2.63 \pm 0.046$.

Structure and color: Integument generally black; bases of mandibles, labrum and clypeus pale yellow to cream-colored; distitarsi, occasionally basitarsi and often apical areas of terga rufescent; antennal scapes dark brown to red; ventral surfaces of flagella bright red to yellow, dorsally dark brown to black; tegulae dark brown to translucent red; wings infumate, veins red to black; eyes as in female, usually yellowish-green or grayish-green. Punctation as in female; minimum length of first flagellar segment as long as one third of maximum length of second segment or longer, but never as long as half of second segment.

Genitalia and hidden sterna with characters of the subgenus (Figs. 24-27). Gonostyli narrowest at about half of distance from base, widest at base, with abundant long plumose hairs on lower half or more, especially on dorsolateral surfaces, only slightly bent, scarcely S-shaped; spatha 3 times as broad as long or slightly broader, usually slightly emarginate medially at apex, with blunt, simple lateral processes. Sternum 7 with abundant plumose hairs on median plates, with short hairs on ventral surface below median emargination; lateral apodemes about equal to median length of sternum. Sternum 8 with lateral apodemes directed laterally; apical transverse carina distinct, bilobed, well separated from apex; abundant apical plumose hairs laterally, usually with one or more strong barbed hairs medially as well.

Hair: Anterior faces of mesepisterna with long pale hairs and sparse, closely appressed pubescence which scarcely obscures the surfaces, without pad of dense appressed pubescence; hairs of hind basitarsi usually dark brown to black; hairs of metasomal sterna red to dark brown, usually dark.

Bionomics. An account of the nesting habits of this species in Colorado has been given by Custer (1928). He found eight entrances in an area of four square meters of earth which was devoid of vegetation and packed by automobiles. Four of the entrances were being used by one female each, two by two females each, one by three females and the last by eight females. Those nests occupied by more than one female were very complicated at the level at which cells were being constructed. Where single females were using individual entrances about 15 cells were present per nest.

The entrance gallery consisted of a short vertical burrow about one to three centimeters deep, a sharp angle in which an antechamber was located and a long gallery slanting down and branch-

ing into other burrows leading to the cells. The cells were placed with their long axes vertical and consisted of a shell of dried mud, a semitransparent membranous lining and a top of unpolished clay arranged in concentric rings.

The parasites observed by Custer were several species of *Triepeolus*, among which the large *T. concavus* was considered by him to be the logical parasite of *obliqua*. An interesting observation made by Custer was that, in addition to more than one female of *obliqua* using the same nest entrance, another species of the same genus (perhaps *M. agilis* Cresson) was also making use of one of these entrances (the one being used by eight *obliqua* females). Custer also observed that there was no animosity displayed towards the *Triepeoli*, these parasites occupying the nests at the same time as the *obliqua* females.

On August 28, 1953, one mile west of Lawrence, Kansas, while studying some halictine bees, Dr. C. D. Michener, Alvaro Wille and Howell V. Daly found a single nest of *M. obliqua*. The entrance to this nest was situated beside a large rock in dry, clayey and rather rocky soil. The nest could not be excavated without disturbing nests of *Augochlorella* and *Halictus* which were being studied and so nothing was learned concerning its architecture. This female, when leaving the nest to forage, left quickly without any apparent orientation flight, flew south over the rock and left the vicinity of the rock in a southeasterly direction. From fourteen to twenty two minutes were spent in the field after which the female consistently returned to the nest from due east, circling during the last eighteen to twenty four inches of flight to enter the nest from the northwest. This pattern was probably produced by the wind which was from the southeast at the time. The bee was obviously foraging in a dense stand of *Helianthus annuus* situated a few hundred yards to the southeast of the nest locality.

Out of over 4,000 specimens available for study, 1,128 have flower labels attached. This allows one to study the flower preferences of this species with some confidence. In Table III are tabulated some of the significant facts concerning these flower records. It is obvious from this tabulation that this species has a decided preference for composites. Of importance is the fact that the proportion of males to females taken is much larger on the non-Compositae than on the Compositae. This indicates that the non-Compositae are of greater importance as sources of nectar than as sources of pollen, an indication that can be readily verified in the field and

has been by Charles Robertson (1928) and others. The Leguminosae are visited by *obliqua* more often than any other family of non-Compositae, but the proportion of males to females is even larger than in the latter. One cannot conclude from this data, however, that *obliqua* uses only composites as pollen sources. Linsley (1946, p. 25) in connection with pollination of alfalfa by this bee states, "It works very fast, is an effective pollinator, but presumably only turns to alfalfa as a pollen source when suitable Compositae are unavailable." The data also show that, among the many plants visited, *M. obliqua* prefers composites of the tribes Heliantheae, Vernonieae, Astereae and Helenieae in that order.

TABLE III.—Summary of floral records for *Melissodes obliqua.*

Family	Number of Families	Number of Genera	Approximate Number of Species	Number of Collections	Number of Females	Number of Males	Total Number of Bees
Compositae	1	26	54	296	682	340	1,022
Leguminosae	1	7	9	22	15	26	41
Others	13	14	15	27	33	32	65
Totals	15	47	78	345	730	398	1,128

Geographical variation. M. obliqua is one of the most abundant species of the genus in the United States. Its range as now known covers virtually the whole of the United States, parts of southern Canada and a large part of northcentral Mexico. Over this area *obliqua* is divisible into three subspecies, *expurgata, obliqua* and *caliginosa,* on the basis of hair color (Fig. 7). The palest of these (*expurgata*) occupies the western part of the range from Washington to Baja California and east through Idaho in the north and through Arizona in the south. Across New Mexico there is a rather even cline grading into the darker subspecies (*obliqua*) of the central states. This cline contracts into a narrow zone of intergradation in the high mountains of Colorado. Specimens from northeastern New Mexico and eastern Colorado are typically *obliqua* and those from western Colorado and most of the remaining area of New Mexico are *expurgata* or intergrades between these subspecies. There are, unfortunately, not enough specimens available

from Wyoming or Montana to describe the zone of intergradation which must occur in those areas. Perhaps the intergrading area widens out again on the high plains of Wyoming. It is quite certain, however, that this species is quite rare in this area, probably because the climate more nearly approaches the limits of tolerance of the species due to the combination of latitude and altitude.

In the east *obliqua* grades into the darker Atlantic Coast subspecies (*caliginosa*) across the Appalachian Mountains. Two males from Tennessee (labeled "Tenn.") are indistinguishable from *caliginosa* and many specimens from extreme western North Carolina bear evidence of gene flow from the paler *obliqua* to the west. In the north *obliqua* and *caliginosa* have both been reported from New Jersey (Smith, 1910), but only one female specimen has been available from this state for study by the present author. This female is a typical specimen of *caliginosa*. A single female from Long Island, New York, is definitely *obliqua*. The intergrading zone must occur in New Jersey, but lack of specimens from that state does not permit adequate description of the zone. It should be mentioned here that this species has not been reported from the New England states and is apparently rare in New York State. In the south typical *obliqua* extends its range along the Gulf Coast to southern Florida and intergrades with *caliginosa* in southern and western Georgia.

There is a great deal of variation in color within the range of each of the subspecies, each locality being characterized by slightly different populations. This can be seen in the percentages of melanism given for various localities in the histograms of figure 6. Each subspecies is characterized by a range of color and this range overlaps that of the neighboring subspecies. Because of this overlap a small percentage of individuals of each subspecies cannot be confidently placed except by locality. The pattern of color characters, however, is quite constant for each subspecies and over the range of each about 80 to 90% of the individuals are readily distinguished from all of the individuals of the neighboring subspecies, except in the zones of intergradation.

All characters studied involved paleness, or rather melanism, and were stated as "either-or" situations, so that the change measured from locality to locality is a change in the percentage of individuals bearing each character. Stated differently for emphasis, there is no well-marked cline for any individual character because the features studied were "either-or" situations. The vari-

ation noted, therefore, is in the percent of individuals bearing the particular character, or, when all characters were combined, it is a gradient of the percent of melanism which is exhibited within the populations. The percentages were obtained by grouping more or less contiguous localities; care was taken to group specimens logically, taking into consideration topography, numbers of specimens available, etc. The groupings of localities from which specimens were studied for this analysis are shown on the map (Fig. 7). It should be emphasized that not all the individuals available from within the areas delimited on the map were used, nor were specimens from all the localities within every area used. Many of the localities plotted on the map as being in the area from which the data were taken were obtained from specimens which became available several months after the analysis was completed. The newer material would not change the histograms materially, however, especially where sufficient material was originally available. In addition, many specimens available were in too poor a condition to be used in this analysis.

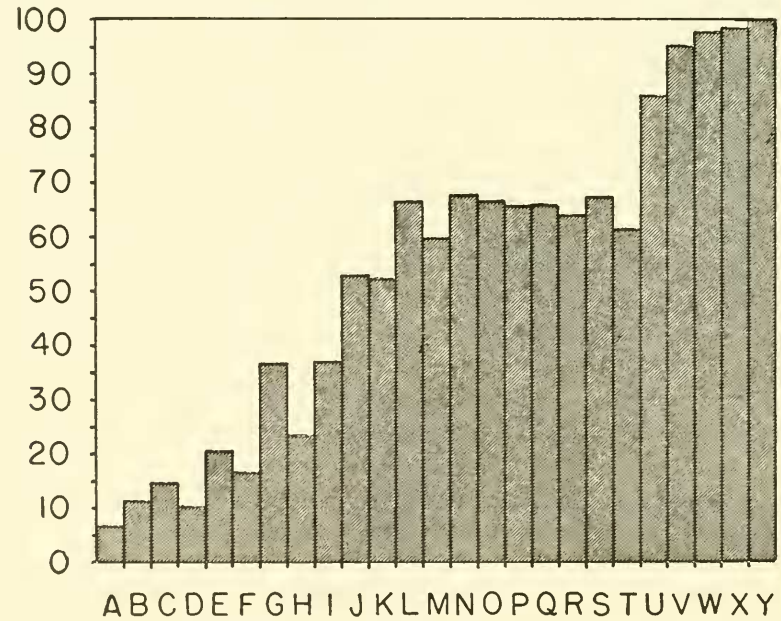

FIG. 5. Histograms for *M.* (*Epimelissodes*) *obliqua* showing the average percentage of melanism of females (ordinate) within each of several localities (abscissa). The derivation of these percentages is explained in the text. The localities are lettered in accord with the graphs in Figure 6 and the areas delimited on the maps (Figs. 7A and 7B). The numbers of specimens are listed in the explanation of Figure 7B.

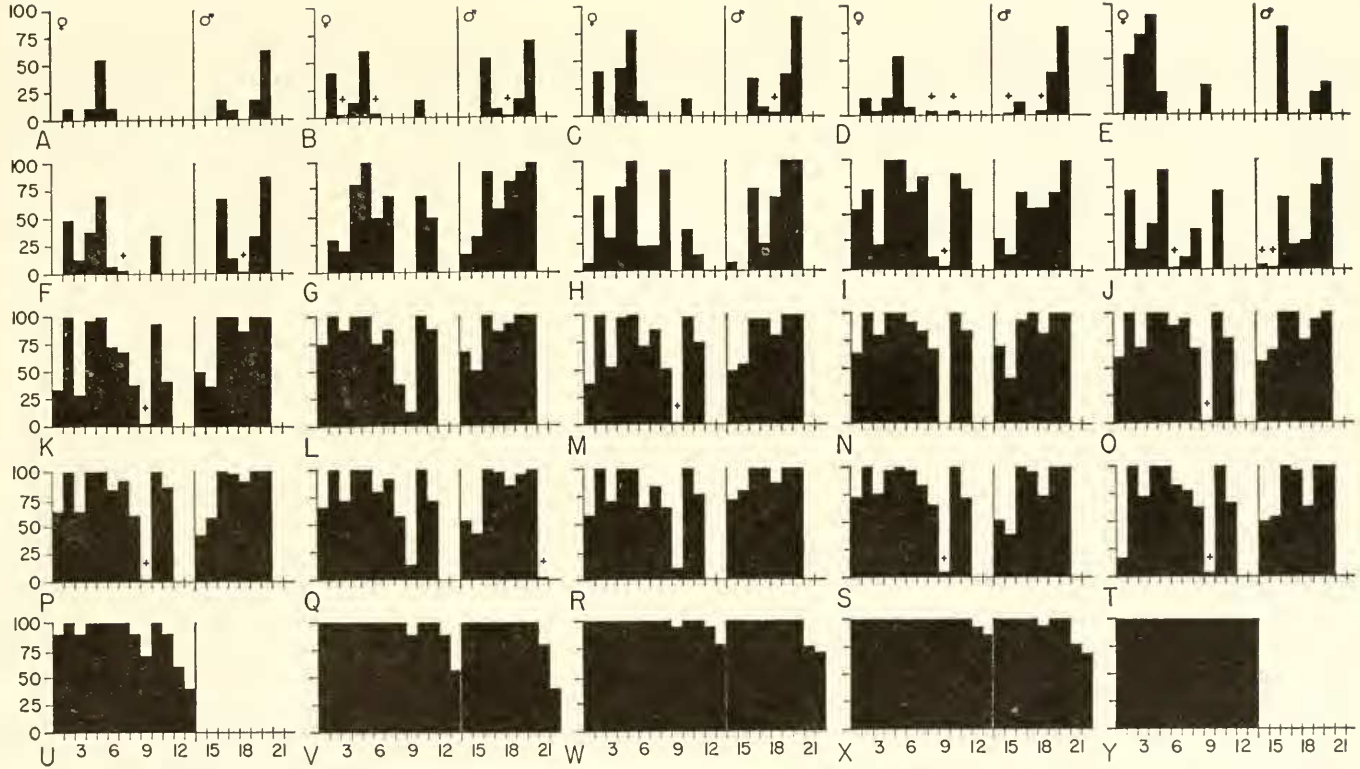

FIG. 6. Histograms showing the percentages of individuals (ordinates) of *M. (Epimelissodes) obliqua* bearing certain characters (abscissas). Characters 1 through 13 refer to females and 14 through 22 refer to males. Each graph is lettered in accord with the areas delimited on the map (Figs. 7A and 7B). The derivation of the percentages and the characters is explained in the text. A small plus mark above a bar indicates less than five percent.

The percentages of melanism for each character and each locality are represented by the bargraphs in Figure 6. General melanism factors for each area were devised from the average of all of the characters studied and are shown in Figure 5 (females only). The differences between the three subspecies can be greatly emphasized by dropping from the graphs all but the three or four characters which are described as diagnostic for each subspecies.

The characters corresponding to the numbers below each bar in the histograms (Fig. 6) are listed below. The first thirteen characters refer to the females, while the remaining nine refer to the males, although they are numbered consecutively. Only the dark alternative is listed for each character. These correspond to the black bars of the histograms.

Female:

1. Pale fasciae absent on tergum 2.
2. Pale fasciae of tergum 2 separated from pale hairs at extreme sides of tergum.
3. Pale hairs absent at extreme sides of both terga 2 and 3.
4. Axillae with more than 50 percent dark hairs.
5. Mesoscutal dark patch reaches a transverse line at middle of tegulae or beyond.
6. Mesoscutal dark patch reaches a transverse line at anterior margins of tegulae or beyond.
7. Tergum 4 with a median triangle, or at least a vertical line, of dark pubescence.
8. Posterior pronotal lobes with dark hairs.
9. Mesoscutum with dark hairs at least medially near anterior margin.
10. Pale pubescent band of tergum 3 narrower than apical area laterally.
11. Tergum 3 with pale pubescent fasciae separated medially by a distance equal to half of one fascia or more.
12. Tergum 4 without pale pubescence, or with pale pubescence reduced to lateral fasciae equal to less than one third of width of tergum.
13. Tergum 3 without lateral fasciae of pale pubescence.

Males:

14. Pale band of tergum 2 interrupted medially by brown pubescence.
15. Pale band on terga 2 and 3 separated from pale appressed hairs at extreme sides.

16. Interband zone of tergum 2 with brown hairs at least laterally.
17. Pale band of tergum 3 narrower medially than apical area.
18. Axillae with at least one or two reddish-brown hairs.
19. Mesoscutum with at least a few reddish-brown hairs posteromedially.
20. Scutellum with brown hairs medially.
21. Tegulae with brown hairs.
22. Mesepisterna with brown hairs at least above.

At least three genetically distinct characters are involved in this "general melanism." In the widening of the pubescent bands on tergum 3 of both sexes not only is color involved, but also a change in form of the hairs from the simple short dark brown hairs of the apical areas of the terga to the longer, highly plumose, white hairs of the pubescent band. Also, there seemingly is one factor operating on the thorax and another on the metasoma, since color changes within any one subspecies are not correlated to any high degree between these body regions, whereas they are highly correlated within either of the body regions. Here, then, is a case wherein at least three characters are highly concordant, although not perfectly so, across a rather long cline between two forms (subspecies *obliqua* and subspecies *expurgata*). This conclusion is considered to be valid, although the genetic picture is probably much more complicated than suggested above.

One can only guess at the reason why most of the specimens from Mexico closely resemble the intermediate forms from New Mexico and do not show a well-marked cline from east to west. Perhaps irrigation on the central plateau area (southern Chihuahua and northern Durango) has permitted the species to extend its range far to the south. Since this area is contiguous with the range of the New Mexico intermediate populations, these would populate the new area. It is more likely that a cline could be shown to exist across this area similar to that across the New Mexico-Arizona area, if more specimens were available from eastern Sonora, from certain areas of Chihuahua and from the more eastern states. A single male from Tamaulipas, two females from Puertas de la Goriona, Coahuila, and two females from Cabos, Coahuila, are the only specimens available from eastern Mexico. The male is probably a typical *obliqua* and is here considered as such, but is so badly worn as to be almost unrecognizable. Of the two females from Puertas de la Goriona, one is a typical *obliqua,* while the other could

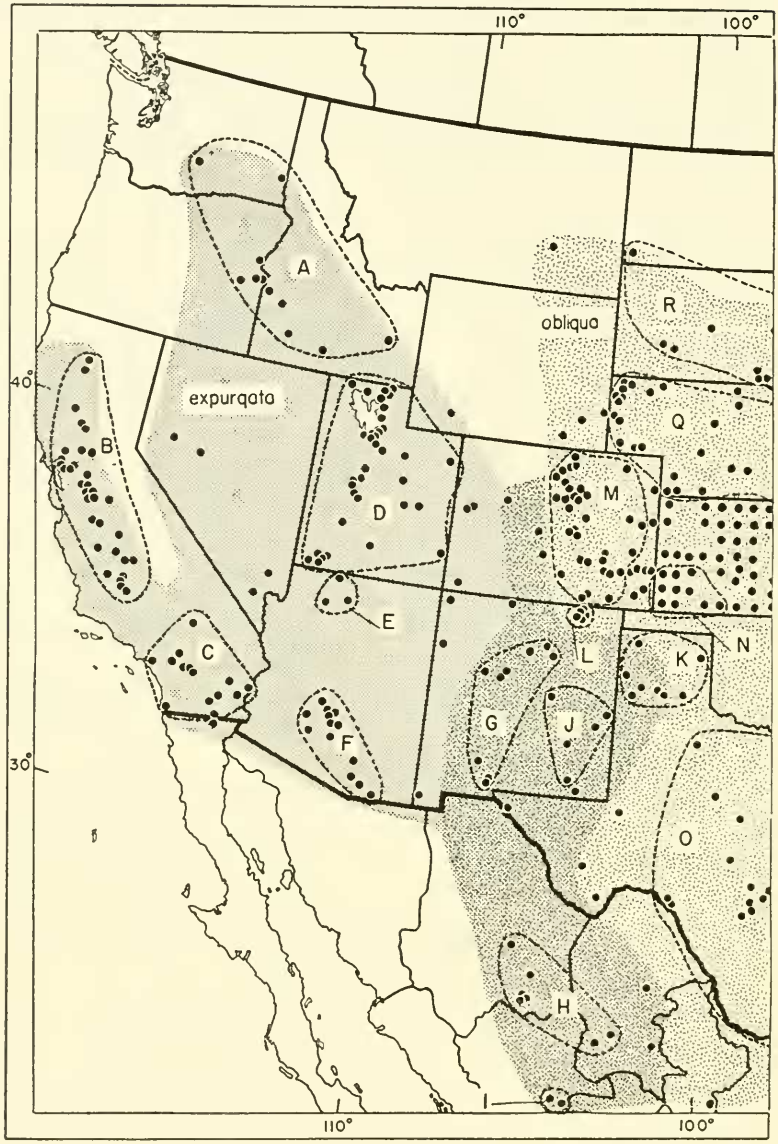

FIG. 7A. Map showing the distribution of *M. (Epimelissodes) obliqua.* Zones of intergradation between the subspecies are indicated by overlapping types of shading. Areas outlined by broken lines include localities from which specimens were taken to produce an analysis of characters. These areas are lettered in accord with the histograms of Figures 5 and 6. Facts such as the conditon of specimens and the numbers of specimens available did not

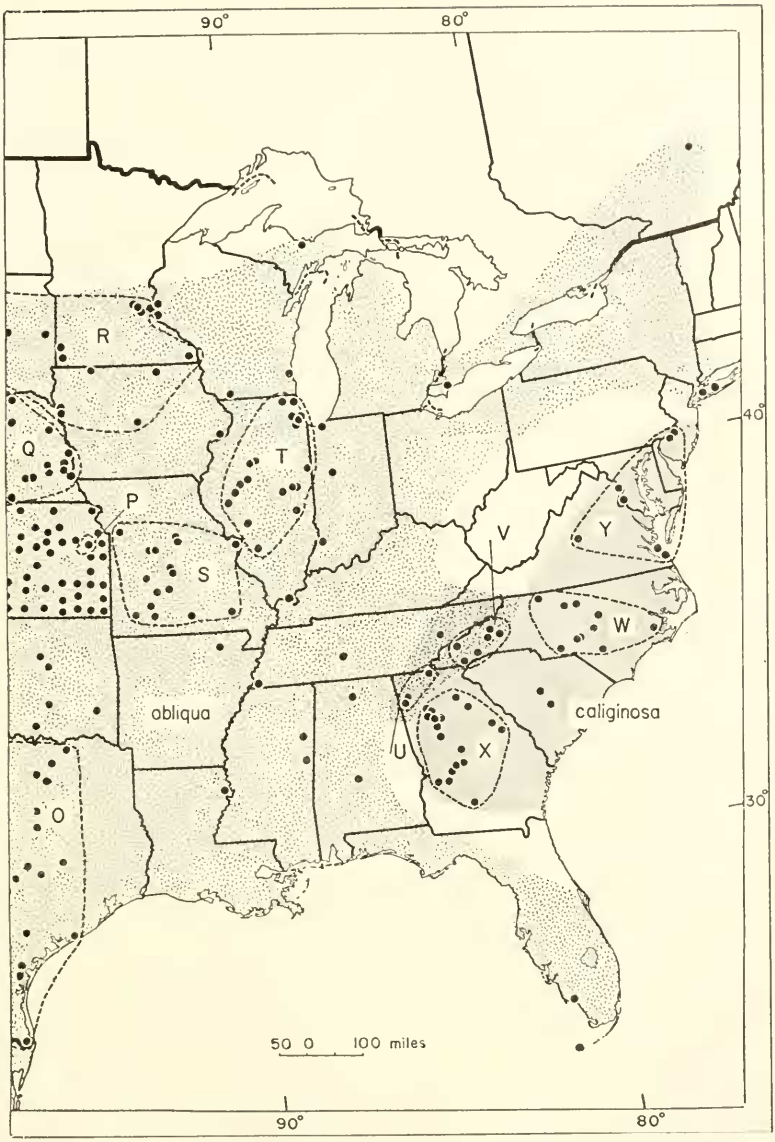

FIG. 7B. permit use of all specimens from some localities, nor all localities within some areas outlined on the map. The following is a list of numbers of specimens used to produce each graph (female precedes male in each case): A 9, 11; B 100, 100; C 29, 23; D 26, 51; E 11, 5; F 89, 56; G 10, 12; H 43, 44; I 13, 12; J 34, 7; K 34, 8; L 8, 14; M 47, 47; N 25, 17; O 65, 32; P 50, 45; Q 50, 50; R 31, 15; S 38, 23; T 30, 24; U 10, 0; V 28, 10; W 19, 17; X 14, 16; Y 9, 0.

be referred to *expurgata*. The two females from Cabos clearly represent an intermediate population. *M. obliqua obliqua* will probably be found throughout Tamaulipas and eastern Coahuila and *M. obliqua expurgata* throughout Sonora.

The descriptions of these three subspecies which follow are based entirely on hair color, since no other characters have been found separating these forms.

Melissodes (Epimelissodes) obliqua caliginosa Cresson.

Melissodes caliginosa Cresson, 1878, Proc. Acad. Nat. Sci. Philadelphia, vol. 30, p. 192; Smith, 1910, Ann. Rept. New Jersey State Museum, 1909, p. 693; Cresson, 1916, Mem. Amer. Ent. Soc., vol. 1, p. 114; Cockerell, 1917, Can. Ent., vol. 49, p. 212; Brimley, 1938, Insects of North Carolina, p. 462; Fattig, 1945, Emory Univ. Mus. Bull., no. 3, p. 5.

This subspecies is distinguished from *expurgata* and *obliqua* by being much darker. The females of *caliginosa* can be separated from those of *obliqua* by a combination of any three of the following four characters: median patch of dark brown pubescence on tergum 4 equals at least one third of the tergum in width and usually more; tergum 2 without oblique pale pubescent fasciae; tergum 1 with long brown hairs mixed with ochraceous in basal half of dorsal face, or all of these hairs brown; with at least a few long brown hairs near anterior margin of mesoscutum mixed with the rufescent hairs. The males can be separated from those of *obliqua* by usually having brown hairs on at least the lower parts of the lateral faces of the mesepisterna and by usually not having pale fasciae on tergum 2 and often not on terga 4 or 5.

Female. Darkest specimens entirely black except for the yellow scopal hairs of the hind tibiae and upper half of hind basitarsi and a few ochraceous hairs in the thick band of spatuloplumose hairs between mesoscutum and scutellum. Palest forms retain dark brown hairs on labrum, anterior third or more of clypeus, vertex between lateral ocelli and apices of compound eyes, and a mixture of brown and ochraceous hairs on face, genae, vertex and occiput. Two spots of ochraceous hairs appear near anterior mesoscutal margin together with a thin line of ochraceous hairs laterally on mesoscutum and ochraceous hairs dorsally on propodeum in paler specimens; these pale thoracic patches of hairs expand until thorax is colored essentially as in *obliqua*, but always with abundant dark brown hairs on posterior pronotal lobes and at least a few long brown hairs medially near anterior margin of mesoscutum; tegulae with dark brown appressed hairs; mesepisterna and lateral faces

of propodeum with dark brown hairs. On metasoma pale hairs appear first in pale basal band of spatuloplumose hairs of tergum 2 and as short oblique lateral fasciae of ochraceous hairs on tergum 3; tergum 4 in next palest specimens acquires lateral maculae of ochraceous pubescence which spread inwards on still paler forms; basal half of tergum 1 in palest specimens with about 50% brown hairs mixed with ochraceous, without tufts of pale hairs at extreme sides of terga 5 and 6. Legs always with dark brown hairs except yellow scopal hairs and red to dark reddish-brown hairs on inner surfaces of hind basitarsi and tibiae.

Male. Head usually with ochraceous to white hairs except short dark brown hairs between lateral ocelli and apices of compound eyes; darkest specimens with brown hairs mixed with ochraceous on vertex, occiput, genal areas and clypeus. Mesoscutum, scutellum and tegulae always with abundant dark brown hairs; axillae with mixed ochraceous and brown hairs; pale hairs of thorax yellow to ochraceous; mesepisterna and metepisterna covered with reddish-brown hairs in darkest specimens, ochraceous hairs first appearing dorsally and extending down to cover lateral surfaces in paler specimens. In darkest individuals metasoma entirely covered with dark brown hairs except for basal hairs of tergum 1 and basal spatuloplumose hair band of tergum 2; pale lateral oblique fasciae appear first on tergum 3, 4, 5 and 2 in that order, these fasciae expanding inwards and laterally until they form complete bands on terga 2 and 3, never with appressed ochraceous hairs at extreme sides. Fore and middle distitarsi and inner surfaces of fore and middle basitarsi with rufescent hairs; inner surfaces of hind basitarsi with dark reddish-brown to black hairs; in darkest individuals fore and middle coxae with ochraceous hairs, outer surfaces of fore basitarsi, fore and middle femora and tibiae with mixed brown and pale hairs, outer surfaces of middle and hind basitarsi and hind femora and tibiae with reddish-brown to black hairs; hairs of legs become paler until hind basitarsi with brown hairs, hind tibiae with brown hairs mixed with ochraceous and ochraceous elsewhere.

Remarks. The concept here presented of *M. obliqua caliginosa* is somewhat different from that entertained up to the present. This form was described by Cresson as a distinct species from some of the darker individuals which exist throughout the range. Paler individuals, a few indistinguishable from the darker specimens of *M. obliqua obliqua,* also have been taken almost everywhere throughout the range of *caliginosa.* A good many of the paler

specimens can be separated from *obliqua* on the basis of the combination of characters given above. The zone of intergradation is limited to that area within which only less than 90% of the females and less than 75% of the males can be distinguished using this combination. The difference in percentage between the sexes was considered necessary because the males of this species, as in most *Melissodes* (see *M. atripes*), are more variable in color and are generally paler than the females.

Type material. Lectotype female and lectoallotype male from Georgia are in the Academy of Natural Sciences of Philadelphia.

Distribution. Atlantic coast states from New Jersey south through Georgia (Fig. 7). This subspecies has been collected from June 17 to November 17, but mostly in July, August and September. Including intermediates * between this subspecies and *obliqua s. str.*, 82 females and 50 males were examined. The localities of these together with those reported in the literature are listed below.

GEORGIA: Americus; Athens; Atlanta; Austell; * Fannin Co.; Griffin; Jonesboro; Kennesaw Mt.; * Lavender, Floyd Co.; Macon; Marshallville; Marietta; Neal Gap; Oglethorpe; Perry; Preston; * Rome; Stone Mt.; Thomson's Mills; Tifton; Warrenton; Wrens. MARYLAND: Indianhead. NEW JERSEY: Gloucester; Westville. NORTH CAROLINA: Aberdeen; Black Mts.; Brevard; * Bryson City; Burlington; Greensboro; Harnett Co.; Highlands; Lake James; Lake View; Marion; McDowell, Yancey Co.; New Bern; Penderlea; Pilot Mount; Raleigh; Southern Pines; Tarheel; Wadesboro. SOUTH CAROLINA: Columbia; Pinnacle; St. Matthews. VIRGINIA: Camp Perry; Falls Church; Lynnhaven; Nelson Co.

Flower records. Both females and males have been taken on the following composites: *Borrichia frutescens, Helenium* sp., *H. tenuifolium, Helianthus* sp., *H. atrorubens, H. microcephalum, H. zonatus, Vernonia* sp., *V. glauca, V. noveboracensis.*

Melissodes (Epimelissodes) obliqua obliqua (Say).

Macrocera obliqua Say, 1837, Boston J. Nat. Hist., vol. 1, pp. 403-404.
Melissodes obliqua, Cresson, 1872, Trans. Amer. Ent. Soc., vol. 4, p. 275; 1875, *in* Wheeler, Report upon geographical and geological explorations and surveys west of the one hundredth meridian, vol. 5, p. 726 (in part); Provancher, 1888, Additions et Corrections au Vol. II de la Faune entomologique du Canada traitant des Hyménoptères, vol. 2, p. 299; Robertson, 1892, Trans. Acad. Sci. St. Louis, vol. 6, pp. 451-476; Townsend, 1896, Can. Ent., vol. 28, p. 140; Cockerell, 1896, Can. Ent., vol. 28, p. 305; 1897, Bull. Agric. Exp. Stat. New Mexico Coll. Agric. and Mech. Arts,

* Localities in western Georgia and North Carolina considered as in, or on the margin of, the zone of intergradation between *caliginosa* and *obliqua.*

no. 24, pp. 20, 28; 1898, Bull. Sci. Labs. Denison Univ., vol. 11, pp. 66-67; 1898, Bull. Univ. New Mexico, vol. 1, pp. 66-67; Robertson, 1898, Botanical Gazette, vol. 25, p. 244; Cockerell, 1899, Entomologist, vol. 32, p. 157; 1899, Ent. News, vol. 10, p. 3; Birkmann, 1899, Ent. News, vol. 10, p. 245; Bridwell, 1899, Trans. Kansas Acad. Sci., vol. 16, p. 211; Cockerell, 1901, Ann. Mag. Nat. Hist., ser. 7, vol. 7, p. 337; 1904, Entomologist, vol. 37, p. 8; Robertson, 1905, Trans. Amer. Ent. Soc., vol. 31, pp. 368, 370; Cockerell, 1906, Trans. Amer. Ent. Soc., vol. 32, pp. 78, 83; 1906, Trans. Amer. Ent. Soc., vol. 32, p. 309; 1907, Univ. Colorado Studies, vol. 4, pp. 254, 255; Hart and Gleason, 1907, Bull. Illinois State Lab. Nat. Hist., vol. 7, p. 257; Tucker, 1909, Trans. Kansas Acad. Sci., vol. 22, p. 278; Graenicher, 1911, Bull. Publ. Mus. Milwaukee, vol. 1, p. 247; Smith, 1910, Ann. Rept. New Jersey State Mus., 1909, p. 693; Cockerell, 1911, Can. Ent., vol. 43, p. 390; Gibson, 1913, Forty-fourth Ann. Rept. Ent. Soc. Ontario, p. 20; Cockerell, 1914, Can. Ent., vol. 26, p. 411; Viereck, 1916, Connecticut Geol. Nat. Hist. Surv., Bull. 22, p. 733; Rau, 1922, Trans. Acad. Sci. St. Louis, vol. 24, p. 34; Cockerell, 1923, Ent. News, vol. 34, p. 48; 1925, Ann. Mag. Nat. Hist., ser. 9, vol. 16, p. 230; Custer, 1928, Can. Ent., vol. 60, pp. 28-31; Cockerell, 1934, Amer. Mus. Nov., no. 697, p. 10; Graenicher, 1935, Ann. Ent. Soc. Amer., vol. 28, p. 304; Cockerell, 1936, Amer. Mus. Nov., no. 831, p. 5; Stevens, 1951, North Dakota Agric. Exp. Stat. Bull., no. 14, p. 30.

Epimelissodes obliqua, Robertson, 1918, Ent. News, vol. 29, p. 92; 1928, Flowers and Insects, p. 8; Pearson, 1933, Ecol. Monographs, vol. 3, p. 380.

M. obliqua obliqua can be separated from *expurgata* and *caliginosa* as described in the diagnoses of each of the latter two subspecies.

Female. Hairs of face and genal areas pale ochraceous becoming rufescent on occiput and vertex; vertex with short dark brown hairs between lateral ocelli and apices of compound eyes and usually at least a few long dark brown hairs mixed with the rufescent above ocelli; labrum with brown hairs. Mesoscutum with large dark brown hair patch extending forward at least beyond a line at middle of tegulae and usually beyond anterior margins of tegulae, hairs anterior to dark hair patch ochraceous to red, occasionally with a few long brown hairs in middle and/or at lateral angles near anterior margin; scutellum covered with dark brown to black hairs, but with pale hairs on margin; band of spatuloplumose hairs between mesoscutum and scutellum white to pale ochraceous; tegulae usually covered with short dark brown hairs; dorsum of pronotum with pale ochraceous to rufescent hairs, posterolateral lobes often with abundant dark brown hairs and usually with a few mixed with the ochraceous; mesepisterna with dark brown hairs, dorsoanterior area of lateral surfaces often with an inverted triangle of ochraceous hairs, often entire surface dark brown; metepisterna and lateral faces of propodeum usually with dark hairs. Metasoma as in species description, but pale oblique pubescent fasciae on tergum 3 usually broadly separated medially by at least half of length of one fasciae, usually distinctly narrower than apical area laterally; tergum 4 almost always with at least a

narrow stripe of dark brown pubescence interrupting the broad apical pale band and often with a diamond-shaped patch of dark pubescence, but this rarely as wide as half width of tergum; tergum 5 and often tergum 6 with tufts of ochraceous hairs laterally; terga 2 and 3 with pale appressed hairs at extreme sides in about half of specimens. Hairs of legs usually all brown except hairs of inner surfaces of middle and hind tibiae red-brown to red, hairs of inner surfaces of hind basitarsi dark reddish-brown to black, occasionally ochraceous on upper part of outer surfaces of middle tibiae and mixed ochraceous and brown on femora; scopal hairs yellow to pale ochraceous, often dark brown on lower halves of basitarsi.

Male. Head usually with ochraceous to yellow hairs, paler on face and genal areas; vertex between lateral ocelli and apices of compound eyes usually with short dark brown hairs; occasionally vertex behind ocelli with a few long brown hairs. Mesoscutum usually with abundant reddish-brown hairs in posteromedian area, but this patch usually more restricted than in *caliginosa* and occasionally absent as in *expurgata;* axillae usually with at least one or two and usually several long brown hairs mixed with the pale; pale hairs of thorax pale ochraceous to yellow, occasionally somewhat rufescent dorsally, but never bright red as in female. Apical area of tergum 1 always with sparse short dark brown pubescence; tergum 2 always with lateral fasciae of pale pubescence which sometimes meet medially, but usually at least narrowly separated by brown pubescence; area basal to pale pubescent fasciae and apical to spatuloplumose band of tergum 2 with dark brown hairs at least laterally; tergum 3 usually with a complete pale band, almost always slightly but distinctly narrower than apical area medially; pale fasciae and bands of terga 2 and 3 confluent with ochraceous appressed hairs at extreme sides of terga in about half of specimens, in others either not confluent or pale hairs absent at sides of one or both terga; terga 4 and 5 with complete ochraceous bands usually well separated from apices; terga 6 and 7 with long dark brown to black hairs; sternal hairs usually all dark brown to black, occasionally pale hairs present on basal sterna and laterally on all sterna. Legs with pale ochraceous hairs except for rufescent hairs on inner surfaces of fore distitarsi and basitarsi, of middle and hind distitarsi and of hind tibiae, dark brown to black on inner surfaces of middle and hind basitarsi, on outer surfaces of hind basitarsi in a majority of specimens and on outer surfaces of hind tibiae in about half of specimens.

Type material. Male types from Indiana lost or destroyed.

Distribution. From Montana in the northwest, east to southern Ontario, south through eastern Wyoming and eastern Colorado to southern Texas and Tamaulipas, Mexico, in the west, south to New Jersey east of the Appalachians and through Pennsylvania, Tennessee and Alabama to southern Florida west of the Appalachians (Fig. 7). This subspecies has been collected from April 5 to the beginning of October. Specimens examined include 1,520 females and 880 males. These, together with records reported in the literature, are listed below. Since well over 1000 specimens are from many localities in Kansas, these are recorded by county only in order to conserve space.

Alabama: Decatur; Selma. Arkansas: Imboden; Knob Hill Reservation. Colorado: Avondale; Benta Fort (near Prowers), Bent Co.; Berkeley; Boulder; Boulder Co.; Boxelder Creek (E. of Aurora), Adams Co.; Brighton; Burlington; Chimney Gulch, Jefferson Co.; Clear Creek; Colorado Springs; Crowley Co.; Denver; Dixon Canyon; Eads, Kiowa Co.; Elbert; Flagler; Fort Collins; Gardner; Granada; Hoehne; Holly; Horsecreek (S. of Buckeye); Koyt's Ranch; La Junta; Lamar; Landaman Creek (S. of Stratton); Las Animas; Lone Rock Draw (near Springfield), Baca Co.; Manitou; Masonville; Midway (5 miles E.); Montclair; Ordway; Platte Canyon (near Waterton); Pingree Park, Larimer Co.; Pueblo; Rock Creek (Colorado Springs); Rocky Ford, Otero Co.; South Park; Sterling; Tobe, Las Animas Co.; Trinidad; Two Buttes Reserve, Baca Co.; White Rock (near Boulder); Wray. Florida: Everglades; Flamingo; Yankeetown. Illinois: Bath; Berkeley; Carlinville; Champagne; Charleston; Chicago; Downers Grove; Havana; Lake Forest; Macoupin Co.; Manito; McHenry; Meredosia; Metropolis; Monticello; Palos Park; Peoria; Spring Bay; Trenton; Urbana; Wellington; Willow Springs. Indiana: Lafayette; McAllister; Mineral Springs; Rush Branch; Vincennes. Iowa: Ames; Davenport; Lake Okoboji; Osage; Sergent Bluff; Sioux City. Kansas: Counties: Allen; Anderson; Barber; Barton; Bourbon; Butler; Chautauqua; Cherokee; Cheyenne; Clark; Clay; Comanche; Cowley; Crawford; Decatur; Dickinson; Doniphan; Douglas; Edwards; Elk; Ellis; Finney; Franklin; Geary; Graham; Grant; Greeley; Greenwood; Hamilton; Harper; Harvey; Haskell; Hodgeman; Jewell; Johnson; Kearny; Kingman; Labette; Lane; Leavenworth; Marion; Marshall; Meade; Miami; Mitchell; Montgomery; Morris; Morton; Neosho; Ness; Norton; Osborne; Ottawa; Pawnee; Phillips; Potta-

watomie; Pratt; Reno; Republic; Riley; Rooks; Rush; Russell; Saline; Scott; Sedgwick; Seward; Shawnee; Sheridan; Sherman; Smith; Stafford; Stanton; Stevens; Sumner; Trego; Wabaunsee; Wallace; Wichita; Wilson; Woodson. LOUISIANA: Tallulah. MICHIGAN: Onota Township, Alger Co. MINNESOTA: Fort Snelling; Hennepin Co.; Houston Co.; Minneapolis; Mound Springs State Park, Rock Co.; Pipestone; Washington Co. MISSISSIPPI: Shuqualak; West Point. MISSOURI: Atherton; Barlow; Buffalo; Columbia (12 miles E.); Kaiser; Lebanon (12 miles E.); Ozark; Ozark Lake; Sedalia; Smithton; Springfield; St. Louis; Verona; Wheatland; Willow Springs. MONTANA: Forsyth. NEBRASKA: Agate; Benkelman; Carns; Child's Point; Crawford; Fairmont; Friend; Gering; Glen, Sioux Co.; Gordon; Haigler; Halsey; Hardy; Hay Springs; Imperial; Jim Creek, Sioux Co.; Kearney; Kimball; Lexington; Lincoln; Lodgepole; Louisville; Malcolm; McCook; Meadow; Mitchell; Monroe Canyon, Sioux Co.; Nebraska City; Neligh; Niobrara; North Platte; Omaha; Rock Co.; Sidney; Sioux Co.; Weeping Water; West Point. NEW MEXICO: Cimarron; Koehler; Maxwell; Raton; Springer. NEW YORK: New York City (West Farms); Long Island. NEW JERSEY: ?Camden Co.? (Fox det.) NORTH DAKOTA: Rhame, Bowman Co. OKLAHOMA: Ada; Ardmore; Perkins; Stroud; Tuskahoma. SOUTH DAKOTA: Badlands; Brookings; Cedar Pass (Badlands); Fort Pierre; Huron; Platt; Ravinia; Wheeler Bridge. TENNESSEE: Maury Co.; Memphis. TEXAS: Abilene; Alpine; * Adrian (10 miles W.); Austin; Bexar Co.; Bonham; Brewster Co.; Brownwood; Canadian; Clarendon; College Station; Comfort; * Dalhart (10 miles S. W.); Dallas; * Dawn; Del Rio; Devils River (near Del Rio); *Fabens; Fedor, Lee Co.; Grapevine; Guthrie; * Hereford; Hill Co.; Loyal Valley; Lytle, Atascosa Co.; Matagordo; McKinney; * Metz; New Braunfels; Nueces Co.; * Palo Duro Canyon; * Palo Duro State Park, Randall Co.; Presidio; San Antonio; San Marcos; Sinton; Southmost, Cameron Co.; Taylor; Waco; Weser. WISCONSIN: Hudson, St. Croix Co.; Milwaukee; Maiden Rock; Prescott, Pierce Co.; Shullsburg. WYOMING: Diamond Ranch, Platte Co.; Laramie; Torrington. COAHUILA: Puertas de la Goriona, Sierra del Carmen. TAMAULIPAS: Santa Cruz. ONTARIO: Chatham. QUEBEC: Cap Rouge (Provancher det.).

Flower records. Abutilon theophrasti, Ambrosia sp., *Asclepias incarnatus, A. syriaca, Aster ericoides, Bidens involucrata, B. aris-*

* Localities from northwestern Texas on the margin of the zone of intergradation between *expurgata* and *obliqua*.

tosa, Blephia hirsuta, Boltonia asteroides, Carduus crispus, Cassia sp., *Cephalanthus occidentalis, Chrysopsis* sp., *Cirsium* sp., *C. discolor, C. lanceolatum, C. undulatus, Cleome* sp., *C. serrulata, Coreopsis* sp., *C. tinctoria, C. tripteris, Echinacea pallida, Erigeron philadelphus, Euphorbia* sp., *Gaillardia* sp., *Gossypium herbaceum, Grindelia* sp., *G. squarrosa, Helenium altissimum, H. autumnale, Helianthus* sp., *H. annuus, H. divaricatus, H. grosse-serratus, H. laetiflorus, H. maximillianus, H. mollis, H. petiolaris, H. scaberimus, H. strumosus, H. tuberosus, Heliopsis helianthioides, H. laevis, Ipomoea pandurata, Kuhnistera purpurea, Lacinaria pycnostachys, Lactuca floridana, Lobelia leptostachys, L. siphillitica, Lythrum alatum, L. salicaria, Medicago sativa, Melilotus alba, Monarda fistulosa, Nepeta cataria, Oenothera biennis, Petalostemum* sp., *P. candidens, P. oligophyllum, Prionopsis* sp., *P. ciliata, Psoralea tenuiflora, Pycnanthemum* sp., *P. flexuosum, P. pilosum, Ratibida* sp., *R. columnaris, R. pinnata, Rudbeckia* sp., *R. hirta, R. laciniata, R. subtomentosa, R. triloba, Schrankia uncinata, Silphium* sp., *S. integrifolium, S. laciniatum, S. perfoliatum, S. speciosum, S. terebinthinaceum, Solidago* sp., *S. missouriensis, S. rigida, S. serotina, Teucrium canadense, Trifolium pratense, Verbena* sp., *V. stricta, Vernonia* sp., *V. baldwinia, V. b. interior, V. fasciculata, Verbesina helianthoides, Zinnia* sp.

Melissodes (Epimelissodes) obliqua expurgata Cockerell.

Melissodes obliqua var. *expurgata* Cockerell, 1925, Ann. Mag. Nat. Hist., ser. 9, vol. 16, p. 230; 1928, Univ. Colorado Studies, vol. 16, p. 114 (*obliqua* var.); 1936, Amer. Mus. Nov., no. 831, p. 5 (*obliqua* var.).

Melissodes obliqua, Cresson, 1875, *in* Wheeler, Report upon geographical and geological explorations and surveys west of the one hundredth meridian, vol. 5, p. 726 (in part); Fowler, 1902, Univ. California Agric. Exp. Stat., p. 322; Cockerell, 1903, Psyche, vol. 10, p. 77; Linsley, 1946, J. Econ. Ent., vol. 39, pp. 20-22, 25; Bohart, Knowlton and Bailey, 1950, Utah State Agric. Coll., mimeo. ser. 371, p. 5.

The subspecies *expurgata* is the palest of the three subspecies of *M. obliqua*. The females of *expurgata* can be separated from those of *obliqua* by a combination of the first of the following four characters plus any two of the next three: lateral oblique pale fasciae present on tergum 2; hairs of axillae 50 percent or more pale ochraceous; pale fasciae on tergum 3 as wide as or wider than apical area laterally; tergum 4 without brown pubescence medially. The males of *expurgata* are less reliably separated from those of *obliqua* than are the females, but a majority can be recognized by a combination of the first of the following four characters plus any two of the next three: pale pubescent band on tergum 2 com-

plete, not narrowly interrupted by brown pubescence medially; tergum 3 with pale band medially at least as wide as apical area and usually wider; axillae without brown hairs; mesoscutum without brown hairs. Additional characters are given below and their relative worth can be judged from the histograms in figure 6.

Female. Wings somewhat less infumate than in *obliqua* or *caliginosa.* Head with ochraceous hairs, paler on face and genal areas; vertex between lateral ocelli and apices of compound eyes with short pale brown to brown hairs. Thorax above with ochraceous hairs, occasionally somewhat rufescent on anterior part of mesoscutum; mesoscutum usually with at least a few brown hairs posteromedially, these becoming more abundant in darker specimens, but brown patch only rarely exceeds level of anterior margin of tegulae; scutellum with large patch of dark brown hairs medially, but usually less than in *obliqua;* axillae usually with less than half of hairs brown; tegulae usually with dark brown appressed hairs medially; mesepisterna as in *obliqua,* but often with more pale hairs above; pronotum with ochraceous hairs only. Basal half of metasomal tergum 1 with long ochraceous hairs; tergum 2 always with lateral oblique fasciae of white or pale ochraceous pubescence; terga 2 and 3 usually with appressed ochraceous hairs at extreme sides and usually these join with pale pubescent fasciae of tergum; tergum 3 with large pale pubescent fasciae which often join medially, or separated medially by less than half of length of one fascia and wider than apical apubescent area of tergum laterally; tergum 4 with broad band of pale pubescence only rarely interrupted medially by a thin, incomplete line of brown pubescence; terga 6 and 7 always with tufts of pale hairs at sides. Legs with dark brown hairs except dark reddish-brown hairs on inner surfaces of hind tibiae, mixed ochraceous and brown hairs of hind femora, dark reddish-brown to red hairs on inner surfaces of hind basitarsi and pale ochraceous to white hairs of scopae.

Male. Head with white to ochraceous hairs, rarely with short brown hairs between lateral ocelli and apices of compound eyes. Thorax in palest specimens completely covered with white to ochraceous hairs; often with reddish-brown hairs on scutellum and a few in posteromedian area of mesoscutum; axillae rarely with a few brown hairs present. In palest specimens all hairs of tergum 1 white or pale ochraceous, usually with short simple brown hairs in apical third to one half; tergum 2 with complete band of white or pale ochraceous pubescence, not interrupted

medially by brown pubescence, usually fused with basal band of spatuloplumose hairs, sometimes with brown hairs between these bands at least laterally, almost always pale band fused with pale appressed hairs at extreme sides of tergum; tergum 3 like tergum 2, but pale basal hairs not spatuloplumose, pale band usually as wide as or wider than apical area medially; terga 4 and 5 with broad complete pale bands; terga 6 and 7 with ochraceous hairs in palest specimens to dark brown in darkest individuals; sternal hairs paler than in *obliqua,* but brown at least medially on last 2 or 3 sterna. Legs with white to ochraceous hairs except rufescent hairs on inner surfaces of fore and middle tarsi and hind distitarsi, dark reddish-brown to black on inner surfaces of hind basitarsi and occasionally brown on outer surfaces of hind basitarsi.

Remarks. This subspecies has a range extending over a considerable area. Specimens from different localities are often quite different from one another. A rather long series of specimens from Davis, California, are among the palest and largest examined, whereas those from the San Francisco area and the central valley south to Riverside, California, average smaller and considerably darker. On the other hand, specimens from the Colorado Desert area, not far south and east of Riverside, average small in size, but pale in color and include the palest specimen seen. Specimens from Arizona definitely show some evidence of gene flow from the darker populations to the east, but most are identifiable as *expurgata.*

Type material. Holotype male from Glenwood Springs, Colorado, July 22-29, F. E. Lutz, is the property of the California Academy of Sciences, deposited temporarily at the Citrus Experiment Station, Riverside, California.

Distribution. This subspecies ranges from Washington in the northwest, south into northern Baja California, east through Idaho in the north and into western Colorado and through Arizona in the south (Fig. 7). It has been collected from May 31 to September 27. Including the specimens from the zone of intergradation in Colorado, New Mexico and Mexico, 697 females and 685 males have been examined from the localities listed below. This list includes localities reported in the literature.

Arizona: Casa Grande; Chandler; Fredonia; Gila Bend (23 miles E.); Graham Mts.; Grand Canyon; Hassayampa, Maricopa Co.; Havaisu Canyon; Huachuca Mts.; Marinette; Mesa; Olberg; Phoenix; Phoenix (6 and 12 miles N.); Sahuarita; Sonoita; Supai; Tempe; Tucson. California: Anaheim; Antioch; Artois, Glenn

Co.; Bakersfield (6 miles E.); Bard; Barstow (20 miles E.); Blythe; Calexico; Coalinga; Coachella Valley; Colorado Desert; Colusa; Davis; Dos Palos; Fresno; Indio; Lake Curry, Napa Co.; Lemongrove; Lemoore, Kings Co.; Lerdo; Lindsay; McFarland; Meridian; Modesto; Niland; Oakley; Oxalis; Palm Springs; Palo Verde Valley; Patterson; Redding; Redlands; Rio Vista; Riverside; Ryer Island; Sacramento; Shafter; Snelling; Tracy; Tulare; Turlock; Vallejo; Vernalis; Westley; Westmorland; Weston, San Joaquin Co. COLORADO: * Glenwood Springs; Grand Junction; * Jim Creek; Mesa Verde; Palisade; Utah Junction. IDAHO: Boise; Fort Hall (near Blackfoot); Hot Springs, Owyhee Co.; Parma; Twin Falls. NEVADA: Desatoya Mts.; Fallon; Las Vegas; Logandale. NEW MEXICO: * Albuquerque; * Eddy Co.; * Elida; * Gallup; * Garfield; * Isleta; * Las Cruces; * Las Vegas; * Malaga; * Mesilla; * Portales; * Rito; Rodeo, Hidalgo Co.; * Roswell; * Santa Fe; * Sapello; Shiprock, San Juan Co.; * Vaughn; Willow Creek, Rio Arriba Co. OREGON: Huntington; Juntura (20 miles E.); Ontario; Vale. UTAH: Beaver Valley; Bountiful; Corinne; Cornish; Cove Fort; Delta; Emery Co.; Erda; Escalante; Fillmore; Grantsville; Greenriver; Harper; Hunter; Hurricane; Ioka; Jensen, Uintah Co.; Jericho; Kings Station, Davis Co.; La Verkin; Lehi; Logan; Lynndyl; Magna; Monticello; North Delta; Ogden; Pahvant; Park Valley; Petersboro; Promontory; Provo; Salt Lake; Salt Lake City; Santa Clara; Tooele; Topaz; Toquerville; Zion National Park; Zion Park Junction. WASHINGTON: Morgan's Ferry, Yakima River; Pullman. WYOMING: Green River. BAJA CALIFORNIA: Mexicali (35 kilometers S. W.). CHIHUAHUA: * Catarinas; * Charcos; * Delicias; * Jiménez; * Salaícas. COAHUILA: * Cabos; * San Pedros de Colonias; * Torreón. DURANGO: * Durango; * Nombre de Dios.

Flower records. The subspecies *expurgata* has been taken on flowers of the following plants: *Achillea* sp., *Artemisia* sp., *Asclepias* sp., *Brassica adpressa, Centaurea* sp., *Centromadia pungens, Chrysopsis grandifolia, C. lanceolata, Engelmannia pinnatifida, Gaillardia* sp., *Geranium atropurpureum, Gilia capitata, Grindelia* sp., *G. camporum, G. nana, Helianthus* sp., *H. annuus, H. bolanderi, H. ciliaris, H. petiolaris, Heliotropium* sp., *Isocoma vernonioides, Medicago sativa, Melilotus alba, Petalostemum flavescens, Pluchea sericea, Ratibida columnaris, Scabiosa* sp., *Solidago* sp., *Verbesina encelioides, Wislizenia refracta.*

* Localities from areas of intergradation.

Melissodes (*Epimelissodes*) *texana* Cresson.

This species is distinguished from the other members of the *obliqua* group by the coarser punctation of the clypeus and the shiny surfaces of the posteromedian area of the mesoscutum. In addition, the females have pale yellow to orange hairs on the inner surfaces of the hind basitarsi, short triangular lateral fasciae on tergum 2 and very coarsely punctate supraclypeal area. The males are easily recognized by the thick pad of dense appressed hairs on the anterior surface of each mesepisternum and by the sculpturing on the lateral surfaces of the mesepisterna as described below.

Female. Measurements and ratios: N, 20; length, 13-17 mm.; width, 5.0-6.5 mm.; wing length, M = 5.12 ± 0.247 mm.; hooks in hamulus, M = 16.70 ± 0.828; flagellar segment 1/segment 2, 2.43 ± 0.028.

Structure and color: Integument of body usually black; legs usually red, femora occasionally dark red to black, ventral and lateral areas of mesepisterna and usually anterior surfaces of mesepisterna bright red; labrum and bases of mandibles translucent orange; mandibles with short golden maculae in apical half; antennae often wholly bright red, scapes and lower surfaces of flagella usually dark red, occasionally black; metasomal sterna and ventrolateral parts of terga red; propodeum often dark red medially; eyes usually blue, occasionally gray or greenish-blue; wing membranes generally clear, somewhat brownish at tips, veins dark reddish-brown to black. Clypeus with large deep rounded punctures separated by half or less of one puncture width in median third of posterior half, ground moderately shiny, finely tessellate; supraclypeal area covered with large crowded deep punctures; eyes bulbous, in facial view about as long as facial width between inner upper angles of eyes; maxillary palpal segments in ratio of about 3:3.5:2.5:1, never with a fifth segment. Posteromedian area of mesoscutum with rather small rounded punctures separated by from half to one puncture width, ground very shiny, only slightly shagreened; scutellum similar but punctures average smaller; lateral surfaces of mesepisterna with large deep punctures twice as wide as those on posteromedian area of mesoscutum, ground reduced to ridges between punctures, slightly or not at all shagreened; dorsal surface of propodeum coarsely reticulopunctate, upper part of declivous face and posterior part of dorsal face with distinct diamond-shaped impunctate area medially, ground densely tessellate. Tergum 1 with coarse punctures separated by less than one puncture

width in basal half or less of dorsal surface; tergum 2 with sparse scattered large punctures and abundant small indistinct punctures in interband zone laterally, the smaller punctures abundant at extreme sides and obsolete or minute and sparse medially; apical areas of terga 1-3 impunctate, dulled by dense shagreening.

Hair: Head with ochraceous hairs on vertex behind ocelli, becoming paler on face and genal areas. Thorax with ochraceous hairs above, becoming paler on sides and beneath; mesoscutum usually with patch of brown hairs; scutellum usually with brown hairs medially. Tergum 1 with pale ochraceous to white hairs on basal half and laterally; tergum 2 with broad white spatuloplumose hair band basally, with white appressed hairs laterally and with strongly oblique, short, lateral fasciae of white pubescence; tergum 3 with long broad oblique fasciae which meet medially or almost so, with white pubescence at extreme sides and with brown tomentum basally; tergum 4 with broad apical band of white pubescence and dark brown tomentum basally. Legs with ochraceous to white hairs, except as follows: fore basitarsi often pale brown; inner surfaces of fore and middle basitarsi reddish or orange; inner surfaces of hind basitarsi and tibiae red to yellow; scopal hairs white to pale ochraceous.

Male. Measurements and ratios: N, 20; length, 11-17 mm.; width, 3.5-6.0 mm.; wing length, $M = 4.94 \pm 0.396$ mm.; hooks in hamulus, $M = 15.30 \pm 0.291$; flagellar segment 2/segment 1, $M = 2.58 \pm 0.036$.

Structure and color: Integumental color as in female; clypeus, labrum and bases of mandibles white to cream-colored; entire metasoma often red. Eyes bulbous, often half as broad as long in facial view and always almost so; minimum length of first flagellar segment longer than one third of maximum length of second segment but distinctly less than half of second segment; maxillary palpi as in female. Punctation much as in female; lateral surfaces of mesepisterna with median areas somewhat depressed, with very small punctures, dulled by dense tessellation and often red in color, these areas somewhat variable in size, but always distinct, confluent with anterior surfaces and enclosed above, posteriorly and usually below by normally coarsely punctate areas similar to the mesepisterna of the female; metasomal tergum 1 with punctate basal areas equal to much more than half of median length of tergum; with distinct punctures separated by less than one puncture width across entire tergum 2 in interband zone.

Gonostyli with much shorter, mostly simple and sparser hairs than in *obliqua;* spatha distinctly emarginate medially, about 4 times as wide as long. Sternum 7 with dense fine simple hairs along inner margins of median plates; with a few short hairs on ventral surface below median emargination. Sternum 8 with transverse carina sharp, reaching apex of sternum and partially hiding median emargination when ventral surface of sternum is perpendicular to line of sight; hairs at apex and in median emargination simple, finer and shorter than in *obliqua* (Figs. 48-50).

Hair: Head and thorax as in female, but usually with less brown hairs on dorsum of thorax; anterior surfaces of mesepisterna with dense pads of closely appressed, ochraceous to orange hairs. Hairs of metasoma and legs variable, described below under each subspecies.

Geographical variation. Cockerell in 1906 named a female collected at Roswell, New Mexico, as *M. texana flaveriae.* Unfortunately, Cockerell gave a very poor description of this female. The holotype has bright red legs, as is often the case in this species, not black as Cockerell stated; the hairs of the sterna and the last two terga are as pale as the paler specimens of this species; the hairs of the axillae and of the laterobasal areas of tergum 2 are dark brown, as in the darker specimens of this species. In short, this female is intermediate in color and more like the Texan than like the Californian and Chihuahuan specimens. Also it is from a locality which is presumably near the eastern margin of the zone of intergradation between the two subspecies described below, if not within the range of *texana* itself. Another complication is the

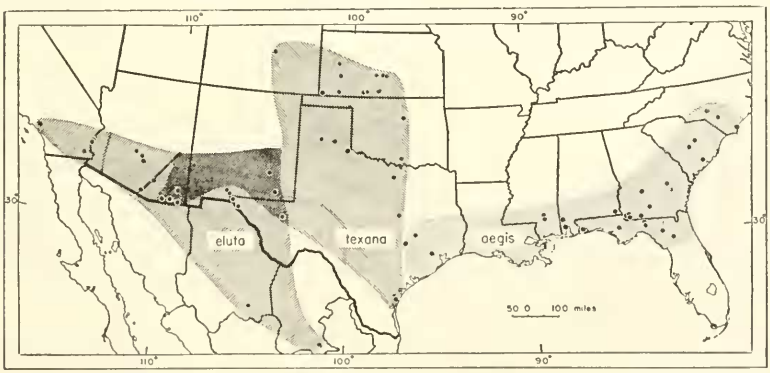

Fig. 8. Map showing the distribution of *M. (Epimelissodes) texana* and *M. (E.) aegis.* The overlapping type of shading indicates the known zone of intergradation between the two subspecies of *M. texana.*

fact that the lectotype of *texana* is rather paler than usual and, thus, the holotype of *flaveriae* and the lectotype of *texana* are indistinguishable. For these reasons *flaveriae* has been synonymized with *texana* and a new name proposed for the pale western subspecies.

The eastern subspecies (*M. texana texana*) is darker, larger and more coarsely punctate than the southwestern subspecies (*M. texana eluta*). Specimens from southwestern Kansas and northwestern Texas show some evidence of becoming paler, but most of these are readily referable to *texana*. Two females from Roswell, New Mexico, are intermediate in character. A single male from Carlsbad, New Mexico, however, is dark. This specimen is considered as being in the zone of intergradation, since dark specimens, especially males, can be expected to occur in the zone of intergradation. Specimens from Las Cruces, New Mexico, and El Paso, Texas, as well as six specimens from Chihuahua, Mexico, are typically *eluta*. Specimens from the extreme southwestern corner of Arizona, however, are intermediate in character and a tendency towards darkness is exhibited in a long series of males from Phoenix, Arizona. Of fourteen females and thirteen males from southern California, all are typically *eluta* save for one male which is slightly darker than usual, but nevertheless referable to *eluta*.

The distribution of these subspecies as described above (Fig. 8) leads to the conclusion that *eluta* is a desert form and that an extensive area of intergradation exists between *eluta* and *texana*. Unfortunately, there are only a few specimens from this large area. A cline may exist across this zone in hair color, but local conditions probably affect color strongly, producing aberrant populations such as those from southeastern Arizona. Until more specimens become available, this zone of intergradation cannot be adequately described.

Melissodes (*Epimelissodes*) *texana texana* Cresson.

Melissodes texana Cresson, 1872, Trans. Amer. Ent. Soc., vol. 4, p. 276; Uhler, 1877, Bull. U. S. Geol. Surv., no. 3, p. 783; Birkmann, 1899, Ent. News, vol. 10, p. 245; Cockerell, 1906, Trans. Amer. Ent. Soc., vol. 32, pp. 77, 86, 108; Cresson, 1916, Mem. Amer. Ent. Soc., vol. 1, p. 132.
Melissodes texana flaveriae Cockerell, 1906, Trans. Amer. Ent. Soc., vol. 32, p. 108 (new synonymy); 1906, Trans. Amer. Ent. Soc., vol. 32, p. 310.

This subspecies is paler and larger than *eluta*. Females of *texana* can be separated from those of *eluta* by a combination of at least three of the following five characters: axillae with 80% or more dark brown hairs; mesoscutal patch of brown hairs extends forward

at least to a transverse line across anterior margins of tegulae; raised areas between pale fasciae and pale spatuloplumose hair bands of tergum 2 covered with short dark brown appressed hairs laterally except at extreme sides; tergum 5 with dark chocolate-brown hairs in medial half or more; sternal hairs at least partly brown. Males of *texana* are more easily separated from males of *eluta* than are the females. Males of *texana* have a rectangular apical dark area on metasomal tergum 1, or this area is narrower medially than laterally, and the pale pubescent band of tergum 2 is as wide as or narrower than the apical area medially and is usually narrowly interrupted medially.

Female. Structure and color: Femora, coxae and lower lateral surfaces of thorax with a tendency to be black; eyes usually bluish-gray, without a greenish tint. Raised lateral areas of interband zone of tergum 2 somewhat more coarsely punctate than in *eluta.*

Hair: With the color characters given above in the diagnosis and in the species description; apical hair band of tergum 4 narrower than in *eluta;* tergum 3 with pale lateral fasciae usually not meeting medially and narrower at extreme sides than in *eluta.*

Male. Structure and color: Metasoma rarely entirely red; eyes usually gray or yellowish, rarely green; clypeus and bases of mandibles usually cream-colored; supraclypeal area never with a triangular pale spot.

Hair: Mesoscutum always with some brown hairs in posteromedian area; scutellum always with a large median patch of brown hairs. First metasomal tergum with long ochraceous hairs laterally and basally, apical median area with a broad zone of short appressed dark brown hairs, this area narrowest medially and with lateral anterior lobes, or quite rectangular in outline, not forming a wide arc anteriorly as in *eluta;* tergum 2 with pale band always separated from basal spatuloplumose band by a narrow zone of dark brown pubescence, band narrowly interrupted medially by brown pubescence and as wide as or narrower than apical area medially; tergum 3 with pale pubescent band usually very narrowly interrupted medially and usually not much wider than apical area medially; pale band of tergum 4 often interrupted medially; terga 4-7 with abundant long dark brown to black bristlelike hairs; terga 6 and 7 with abundant dark brown to black appressed hairs at least medially; sterna usually covered with black or brown hairs, occasionally reddish basally and laterally. Legs pale except red

hairs of inner surfaces of distitarsi and basitarsi of fore and middle legs; hairs of inner and posterior surfaces of hind basitarsi often dark reddish-brown to black.

Type material. Lectotype female and lectoallotype male, one female paratype and one male paratype of *texana* in the Academy of Natural Sciences of Philadelphia. Holotype female of *flaveriae* from Roswell, New Mexico, August, on *Flaveria angustifolia*, T. D. A. Cockerell, is the property of the California Academy of Sciences, temporarily deposited at the Citrus Experiment Station, Riverside, California.

Distribution. Eastern Colorado and Kansas, south through Oklahoma and Texas (Fig. 8). Specimens examined from the localities listed below include 40 females and 23 males, in addition to the type material. This list includes localities recorded in the literature.

COLORADO: Colorado Springs. KANSAS: Coldwater, Comanche Co.; Comanche Co.; Elkhart, Morton Co.; Garden City, Finney Co.; Hudson; Hutchinson; Medicine Lodge; Reno Co.; Scott Co.; Seward Co. NEW MEXICO: * Roswell; * Carlsbad. OKLAHOMA: Ardmore; Stillwater. TEXAS: Clarendon; Corpus Christi; Greenwood; Lake Childress, Childress Co.; Palo Duro State Park; * Pecos; Waco.

Flower records. Females have been collected on the following flowers: *Chrysothamnus* sp., *Flaveria angustifolia, Helianthus* sp., *Prionopsis* sp. and *P. ciliatus.*

Melissodes (Epimelissodes) texana eluta, subsp. nov.

This subspecies can be separated from *texana* on the basis of the characters described in the diagnosis of the latter. In addition, the males of *eluta* often have the supraclypeal triangle cream-colored.

Female. Structure and color: Legs, thorax and metasoma with a tendency towards maximal red coloration; laterobasal raised areas of tergum 2 usually less punctate than in *texana.*

Hair: Mesoscutum with no brown hairs in palest specimens and usually with a much restricted patch of dark hairs in darker specimens; scutellum usually with brown hairs medially; axillae usually with only pale hairs, but a few to several brown hairs often present. Laterobasal raised areas of tergum 2 with hairs all or almost all white so that lateral oblique fasciae appear to fuse with basal spatuloplumose hair band; tergum 3 with white hairs basally at extreme sides, pale oblique fasciae usually meeting in midline; tomentum

* Localities considered to be in the zone of intergradation in New Mexico and Texas.

at bases of terga 3 and 4 often pale brown or orange; tergum 4 with broader apical white band than in *texana;* tergum 5 with orange or pale brown hairs in small median area, white laterally; sternal hairs orange to white, paler apically and laterally on each sternum.

Male. Structure and color: Metasoma with a tendency to be all red; supraclypeal area often with a triangular cream-colored spot; clypeus usually white. Punctures in interband zone of tergum 2 less distinct and less abundant than in *texana.*

Hair: Mesoscutum usually without brown hairs; apical area of metasomal tergum 1 with short brown hairs, narrow, evenly attenuate laterally so that anterior margin of area forms wide arc, never rectangular or lobed anterolaterally as in *texana;* pale band of tergum 2 usually wider than apical area medially, usually with pale pubescence in interband zone, rarely pale band interrupted medially; terga 3 and 4 with pale bands broader than in *texana;* tergum 5 with pale band not interrupted medially; terga 5-7 often with white or pale ochraceous bristlelike hairs and terga 6 and 7 with at most brown hairs medially, often all hairs white or pale ochraceous; sternal hairs usually pale reddish, often reddish-brown medially on last 2 or 3 sterna; legs always with white to ochraceous hairs except yellow to orange hairs on inner surfaces of tarsi, including hind basitarsi.

Type material. Holotype male, allotype female, six female paratypes and four male paratypes collected at Ripley, Riverside Co., California, August 19, 1946, by P. D. Hurd on wild asparagus; six female and six male paratypes collected at Blythe, Riverside Co., California, August 19, 1944, by J. W. MacSwain. The holotype and allotype are in the California Academy of Sciences. Paratypes are in the collections of the California Academy of Sciences, the U. S. National Museum, the American Museum of Natural History, the Snow Entomological Museum and in the author's collection.

Distribution. Desert areas of southern California, Arizona and northern Mexico (Fig. 8). This subspecies has been collected from July 11 to October 15. Including the type material, 44 females and 64 males have been examined from the localities listed below.

Arizona: Baboquivari Mts.; Chandler; * Dos Cabeza (16 miles S. E.); * Douglas; * Hereford; * Huachuca Mts.; Phoenix; Sacaton;

* Localities from the zone of intergradation in Arizona.

Tucson. CALIFORNIA: Blythe; Imperial Co.; Ripley; Yerba Linda, Orange Co. NEW MEXICO: Mesquite, Dona Ana Co. TEXAS: Between La Tuna and Vinton, El Paso Co.; Ysleta. CHIHUAHUA: Delicias. COAHUILA: Cabos.

Flower records. Both sexes have been taken visiting flowers of wild asparagus, one male on *Asteraginus* sp., and one male on *Helianthus* sp. in southern California, and females have been taken on *Helianthus annuus* and *Heterotheca subaxillaris* in Arizona.

Melissodes (Epimelissodes) sila, sp. nov.

Melissodes sila is distinguished from all other species of the *obliqua* group by not having the pale pubescence on metasomal tergum 2 restricted to lateral fasciae, but continuous across the tergum and separated from the apex by only a narrow bare margin equal to about one fifth of the length of the tergum in unworn specimens. The pale pubescence is easily rubbed off of the apical area of the tergum and most specimens have either a thinner band or only lateral fasciae remaining. The female of *sila* is also recognizable by its very pale color. The mesoscutum is without brown hairs and the scutellum has only a small median patch of dark hairs at most. The pale hairs of the head and thorax are white to pale yellowish-ochre, and are not at all rufescent. The males of *sila* are similar to those of *obliqua* in that there is no dense pad of closely appressed hairs on the anterior surface of each mesepisternum. They can be separated from the males of *obliqua* by being paler than the palest specimen of the latter species and by having yellow to orange hairs on the inner surfaces of the hind basitarsi and ochraceous hairs on the last two metasomal terga.

Female. Measurements and ratios: N, 15; length, 13-14 mm.; width, 5-6 mm.; wing length, $M = 4.80 \pm 0.313$ mm.; hooks in hamulus, $M = 17.67 \pm 0.333$ mm.; flagellar segment 1/segment 2, $M = 2.48 \pm 0.044$.

Structure and color: Integument generally black; distitarsi, apical sixth of clypeus and labrum rufescent; occasionally basitarsi, tibiae, coxae, lower lateral surfaces of propodeum and bases of mandibles rufescent; apical margin of metasomal tergum 1 usually piceous, never sharply delimited as a completely transparent margin; sterna usually rufescent, especially basal sterna; mandibles with elongate golden maculae over apical half to three fifths; antennae occasionally all dark brown to black, but usually red to dark reddish-brown be-

low on flagellar segments 3-12; eyes gray to bluish-gray; wing membranes clear or slightly milky, never infumate, veins dark reddish-brown to black; tegulae somewhat translucent, reddish-brown to red; clypeus with moderate-sized, round punctures separated by half or less of one puncture width in median third of posterior half of clypeus, but not as crowded in this area as in *comanche*, ground tessellate, moderately shiny; supraclypeal area with shallow scattered punctures much smaller than those of adjacent area of clypeus, ground shagreened; eyes short, width in facial view equals three eighths length or more, distinctly shorter in facial view than width of face at inner upper angles of eyes; second flagellar segment on ventral surface short and broad, length equals about three fourths width, much shorter than third segment; maxillary palpal segments in ratio of about 3:3:2.5:1, small fifth segment present in most specimens examined and sometimes almost as long as fourth segment. Flattened posteromedian area of mesoscutum with moderate-sized punctures separated by one to one half of a puncture width, ground shagreened, moderately shiny; scutellum coarsely punctate, punctures distinctly smaller than those on mesoscutum, ground shiny, only slightly shagreened; lateral surfaces of mesepisterna coarsely punctate, punctures larger and more crowded than those on mesoscutum; dorsal face of propodeum with large coarse scattered punctures medially and apically, reticulopunctate basally and laterally, ground coarsely tessellate; declivous face with large impunctate inverted triangular area dorsally, ground coarsely tessellate; lateral faces coarsely punctate and tessellate dorsoposteriorly and with fine round punctures and fine shagreening anteroventrally. Metasomal tergum 1 with punctures in basal half of dorsal surface, but anterior half or more of punctate area with shallow punctures separated by one to three puncture widths; apical area finely shagreened, moderately shiny; tergum 2 with interband zone with large shallow sparse punctures, at least laterally, ground dulled by dense shagreening.

Hair: Generally very pale in color; head with white hairs, often very pale ochraceous on vertex and behind ocelli and paler on face and genal areas. Thorax with pale yellowish-ochre hairs above and whitish to white hairs on sides, becoming paler ventrally; scutellum occasionally with pale brown hairs medially. First metasomal tergum with pale ochraceous hairs basally and laterally, apubescent apically; tergum 2 with white basal spatulo-

plumose hair band, area apical to spatuloplumose band completely covered with white or pale ochraceous pubescence in fresh specimens except apical fifth of tergum which is bare, this pubescence divided into three areas by a thick median band of longer pubescence which lies about 3 hairs thick, this thick median band being comparable to the oblique lateral fasciae of other members of the *obliqua* group, shorter pubescence of the apical area sparse, the hairs scarcely overlapping each other and easily rubbed off, but the extent of the pubescent area versus the relatively apubescent margin can be easily determined by presence of exceedingly minute punctures on the former; tergum 3 covered by whitish pubescence which reaches apex of tergum at least in lateral fifth, also divided into basal area of thick pubescence and apical area of sparser pubescence which is readily rubbed off at least medially; tergum 4 with broad apical band of white pubescence; terga 3 and 4 with brown tomentum basally; terga 5 and 6 with hairs white laterally and pale rufescent to pale brown medially. Legs with white hairs except rufescent hairs of inner surfaces of distitarsi, yellow to orange hairs of outer surfaces of fore basitarsi and middle tibiae; scopal hairs white.

Male. Measurements and ratios: N, 6; length, 13-14 mm.; width, 4-5 mm.; wing length, $M = 4.42 \pm 0.382$ mm.; hooks in hamulus, $M = 15.33 \pm 0.459$; flagellar segment 2/segment 1, $M = 3.09 \pm 0.179$.

Structure and color: Color as in female; labrum white; bases of mandibles and clypeus cream-colored to pale yellow. Punctation as in female, but punctate basal area of tergum 1 equals three fifths or more of dorsal face of tergum; maxillary palpi as in female; minimum length of first flagellar segment equals one third or more of maximum length of second segment, but always distinctly less than one half of second segment; eyes bulbous, little more than twice as long as broad in facial view.

Gonostyli more S-shaped and with shorter, sparser and less plumose hairs than in *obliqua;* spatha not emarginate medially. Sternum 7 as in *obliqua* but hairs of median plates simple and stout, without hairs on ventral surfaces below median emargination and without hairs on dorsal surface of lateral plates as in *grandissima.* Sternum 8 as in *obliqua* but apical hairs simple or with few barbs and apical margin gently sloping inwards to the median emargination, without truncated apical margin on each side of emargination.

Hairs: Much as in female; hairs of head, thorax and metasoma entirely pale ochre in presumably younger individuals, as in the holotype, becoming almost white in older individuals; without dense pad of closely appressed hairs on anterior face of each mesepisternum, but with a thin layer of appressed pubescence which effectively screens surface on at least lower half; hairs of inner surfaces of basitarsi yellow to orange.

Remarks. This species is apparently primitive in that the maxillary palpi are usually 5-segmented. It is intermediate in character between *obliqua* and *suffusa* groups in several respects, but is, perhaps, more closely related to *M. obliqua* than to any other species of *Epimelissodes.*

Type material. Holotype male and allotype female collected near San Simon, Arizona, July 12, 1952, by R. H. and L. D. Beamer, W. E. LaBerge and Cheng Liang, on *Psilostrophe cooperi.* Three male paratypes and three female paratypes were taken with the holotype and allotype. In addition, 4 male and 11 female paratypes are as follows: Turner, Arizona, 1 male, August 9, 1940, on *Baileya* sp., P. H. Timberlake; ten miles southwest of Apache, Arizona, 1 male, August 11, 1940, on *Kallstroemia grandiflora,* P. H. Timberlake; Graham Mountains, Arizona, 1 female, August 15, 1953, on "crown beard," G. D. Butler; Tenapin Banks, Big Bend National Park, Brewster Co., Texas, 1 male, July 15, 1950, Ray F. Smith; Charcos, Allende District, Chihuahua, 6 females, July 27, 1947, on "yellow composite," C. D. Michener; 16 miles southeast of Chihuahua, Chihuahua, 1 female, July 11, 1947, W. J. Gertsch; Catarinas, Chihuahua, 2 females, July 26, 1947, Mont A. Cazier; 27 miles west of Chihuahua, Chihuahua, 1 female, August 15, 1950, Ray F. Smith; south of Parrita, Chihuahua, 1 male, August 13, 1950, Ray F. Smith. The holotype and allotype are in the Snow Entomological Museum. Paratypes are in the collections of the California Academy of Sciences, the Citrus Experiment Station, Riverside, California, the American Museum of Natural History and in the author's collection. (Figure 4.)

THE PETULCA GROUP

This group consists of two very closely allied species with two and three subspecies each. The group is characterized by having broad apical bands of pubescence on metasomal terga 2 to 4 in the females and on at least tergum 2 in the males (often on terga 3 to 5 as well). The bands are composed of diffuse, plumose,

closely appressed hairs which are usually pale in color. In the males of one form this diffuse pubescence is reddish-brown apically so that there appears to be a median pale band as in the members of the *obliqua* group. However, the darker apical hairs are long, largely plumose, diffuse, effectively obscure the surface of the integument and are quite unlike the short, simple, dark hairs in a comparable position in species of the *obliqua* group.

Female. Clypeus with small punctures, in posteromedian area often sparated by one or slightly more puncture widths, more crowded elsewhere, densely tessellate; supraclypeal area with very shallow, small, sparse punctures, ground usually densely tessellate but quite often shiny and smooth; maxillary palpal segments in ratio of about 3:3:3:1, first segment occasionally somewhat shorter and minute fifth segment rarely present; second flagellar segment always broader than long ventrally and shorter than third segment. Mesoscutum coarsely punctate, punctures in posteromedian area usually separated by half or less of one puncture width, occasionally by more, ground moderately shiny, usually shagreened; punctures in median area of scutellum distinctly smaller and more crowded than on posteromedian area of mesoscutum, ground shiny, shagreening slight or absent; dorsal face of propodeum reticulopunctate basally and laterally, punctures distinct apically; declivous face of propodeum coarsely punctate, with irregular oval impunctate dorsomedian area; lateral faces of propodeum coarsely punctate posterodorsally and finely punctate anteroventrally; propodeum dulled by dense tessellation; lateral surfaces of mesepisterna with coarse punctures of about same diameter as those on posteromedian area of mesoscutum or slightly larger, more crowded, ground shiny, scarcely or not at all shagreened. Metasomal tergum 1 with coarse punctures in basal half or less medially, extending to margin laterally, punctures small, crowded, ground dulled by dense shagreening basally and shagreened but moderately shiny in apical impunctate area; terga 2 and 3 with punctures in raised lateral areas of interband zone obscured by dense tessellation or shagreening, surface beneath apical hair bands dulled by fine shagreening, with extremely minute punctures no wider than the bases of appressed hairs which they bear, an arched row of coarse punctures separate apical area from interband zone.

Hairs generally of moderate length; head and thorax generally with pale ochraceous hairs, often white on face, genal areas and lower lateral surfaces of thorax, usually with abundant brown

hairs on scutellum and posteromedian area of mesoscutum; terga 2 to 4 with broad apical bands of closely appressed, diffuse, pale pubescence. Scopal hairs highly plumose, white to pale ochraceous.

Male. Sculpturing as in female; punctures on clypeus obscured by color; usually more than half of basal area of tergum 1 coarsely punctate; maxillary palpi as in female; minimum length of first flagellar segment equals slightly less than half of maximum length of second segment and always more than one third of second segment; eyes bulbous, in facial view almost half as wide as long as always much more than one third as wide as long.

Gonostyli always somewhat S-shaped, capitate and with fewer and shorter hairs than in *obliqua;* spatha usually broadly emarginate medially and sinuate laterally, 3 to 4 times as wide as long. Sternum 7 as in *obliqua.* Sternum 8 as in *obliqua;* transverse carina well separated from apex of sternum and usually blunt; hairs at apex shorter and sparser than in *obliqua.*

Hair much as in female; anterior surfaces of mesepisterna covered by dense pads of closely appressed pale pubescence; metasomal tergum 1 with long pale hairs on basal three fifths or more; pale pubescent band on tergum 2 apical, if with reddish-brown hairs apically, these largely plumose, long and effectively screen surface of tergum; terga 3-5 usually with apical pale hair bands, but occasionally with a very narrow apical fringe of brown hairs, especially on terga 4 and 5.

Melissodes (*Epimelissodes*) *petulca* Cresson.

This species can be separated from *sabinensis* by its usually nonhyaline metasomal terga, often darker hair color, more coarsely punctate metasomal terga, shorter and usually dark appressed hairs in the apical area of tergum 1 of the female and the more plumose and shorter hairs in a comparable position in the male. In addition, the male of *petulca* usually has a peculiar vertical fan of several rather stout hairs in the apical emargination of the eighth sternum, has the lateral excavation of the lateral plate of the seventh sternum distinctly shorter than half of the length of the lateral plate, and lacks the patch of close-set hairs on the lateral surfaces of the mesepisterna. Certain females of *M. petulca suffusa* are indistinguishable from some specimens of each of the three subspecies of *sabinensis* on the basis of color characters. These are discussed more fully below. The only morphological characters found which will separate the females of the two

species in all cases are very subtle and to some extent depend on the condition of the specimens.

Female. Measurements and ratios: N, 20; length, 10-15 mm.; width, 4-6 mm.; wing length, $M = 4.46 \pm 0.306$ mm.; hooks in hamulus, $M = 16.15 \pm 0.062$; flagellar segment 1/segment 2, $M = 2.32 \pm 0.031$.

Structure and color: Integument generally black; distitarsi rufescent, remainder of legs dark reddish-brown to black; bases of mandibles, labrum and apical sixth or less of clypeus often translucent yellowish-red; scape and flagellar segments 1 and 2 dark brown to black, remainder of flagella dark red below and dark reddish-brown to black above; eyes yellowish-green to brownish-gray; wing membranes clear, slightly infumate apically, veins dark reddish-brown to black, darker apically; first metasomal tergum with very narrow hyaline margin which is usually sharply delimited basally, occasionally more broadly hyaline, but only rarely as much as half of tergum hyaline; sterna often red, especially basally and laterally. Mesoscutal punctures often separated by one puncture width or more in posteromedian area; tergum 2 with raised areas of interband zone with abundant punctures at least laterally; terga 3 and 4 similar, punctures in lateral areas coarse, separated by less than one puncture width, those bearing long bristlelike hairs not conspicuously larger than those bearing shorter plumose hairs, ground dulled by dense shagreening, but moderately shiny at extreme sides just mesad of lateral arms of graduli.

Hair: Apical impunctate area of tergum 1 with minute, usually dark brown or golden-brown, sparse, appressed hairs which are distinctly shorter than the plumose hairs near margin of tergum 2; terga 3 and 4 with brown tomentum at extreme bases; additional color characters described below for each subspecies.

Male. Measurements and ratios: N, 20; length, 9.5-14.5 mm.; width, 3.5-5.5 mm.; wing length, $M = 4.18 \pm 0.331$ mm.; hooks in hamulus, $M = 14.70 \pm 0.252$; flagellar segment 2/segment 1, $M = 2.77 \pm 0.046$.

Structure and color: Labrum white; clypeus and bases of mandibles pale yellow, white in faded specimens; scape usually dark brown to black, occasionally red; flagellum dark brown to black above, clear red below; eyes yellowish-green, often brownish when faded; wing membranes clear, veins red to brownish-black, darker

apically. Sculpturing and structure as in female; raised lateral areas of terga 2-6 (especially 3 and 4) as in female, but often less punctate.

Spatha gently emarginate apically. Sternum 7 with abundant plumose hairs at apices of median plates; lateral excavations of lateral plates distinctly shorter than half of length of lateral plates; apodemes not expanded nor curved anteriorly in apical third or fourth, inner margins quite straight (Fig. 57). Sternum 8 usually with a median vertical row of six or more stout barbed hairs, in lateral view these hairs form a fanlike structure within the apical emargination.

Hair: Tergum 1 with appressed hairs in apical impunctate area not reaching margin of tergum, short, mostly plumose (or at least plumose basally with simple rachis extending out beyond plumose part); lower half of lateral surface of each mesepisternum with hairs no thicker than elsewhere on lateral surface and punctures bearing these hairs not much crowded; additional color characters are described below for each subspecies.

Geographical variation. *Melissodes petulca* is divisible into two subspecies mainly on the basis of color and slight differences in punctation. The darker eastern subspecies (*petulca*) is distributed over a considerable area east of Texas. The paler subspecies (*suffusa*) ranges over the southwestern states and northern Mexico and intergrades with *petulca* through a cline in the eastern half of Texas.

The zone of intergradation in Texas is illustrated on the map (Fig. 9) by pie-graphs. North of Texas the two subspecies probably meet and intergrade in the eastern half of Oklahoma and eastern Kansas or western Missouri. There are too few specimens from these states to be able to describe the zone in this area. There is some indication of gene flow from *petulca* southward along the eastern coast of Mexico. Two females from the state of Tamaulipas are almost perfectly intermediate in color between the two forms. The large majority of specimens from Mexico are typically *suffusa*, however.

The pie-graphs (Fig. 9) were derived by an analogous method to that used in obtaining the average melanism percentages in the graph (Fig. 5) for *M. obliqua*. In this case three states for each of four characters were tabulated (rather than "either-or" situations): dark, intermediate and pale. An average percent for each was then obtained and these results were used to produce the pie-graphs. As a check, the same specimens were classified as *petulca*,

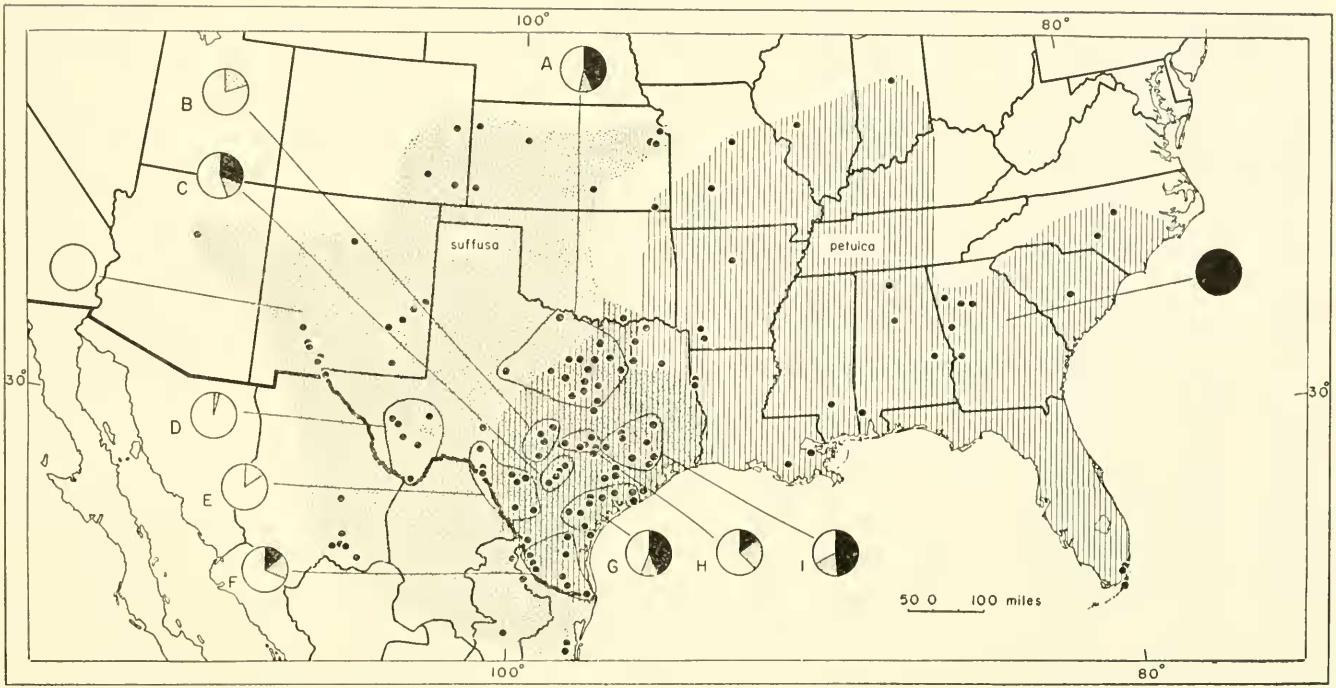

FIG. 9. Map showing the distribution of *M.* (*Epimelissodes*) *petulca*. The overlapping type of shading indicates the known zone of intergradation between the two subspecies. Localities from which specimens were taken to produce the pie-graphs are outlined with a solid line. The graphs represent average melanism of females based on four characters (see text). *M. petulca petulca* is represented by a complete black circle to the right and *M. petulca suffusa* by a white circle to the left.

suffusa or intermediates, according to the three characters given in the diagnoses of the subspecies. The results were again put into the form of pie-graphs and compared with the previous work. No important differences were found to exist between the two methods. In the second method, however, the intermediate classes were generally diminished in favor of one or both of the other classes, since classifying on the basis of only two out of three characters tended to hide the expression of some of the intermediate characters. These pie-graphs are for females only, since the males are more variable. The males, however, follow the results shown in Figure 9 quite closely in average percent of melanism.

The characters used are listed below. The darkest alternatives (*a*) are listed first and correspond to the black parts of the graphs. The intermediate conditions (*b*) correspond to the stippled portion of the graphs and the pale alternatives (*c*) correspond to the white parts of the graphs.

1a. Black mesoscutal hair patch extends anteriorly beyond a transverse line at anterior margins of tegulae and near anterior margin extends laterally beyond parapsidal lines.

1b. Black mesoscutal hair patch extends anteriorly from a transverse line at middle of tegulae to one at anterior ends of tegulae and near anterior margin is contained within parapsidal lines.

1c. Black mesoscutal hair patch small, not extending forward to a transverse line at middle of tegulae, or rounded anteriorly and well within parapsidal lines anteriorly, or both.

2a. Axillae with more than 50% of hairs dark brown.

2b. Axillae with dark hairs, but less than 50% dark.

2c. Axillae without dark hairs.

3a. Tergum 2 with brown hairs extending posteriorly beyond the row of coarse punctures which separated the apical area from the basal area.

3b. With few brown hairs medially extending posteriorly beyond the median row of coarse punctures on tergum 2.

3c. Without dark hairs extending posteriorly beyond the median transverse row of coarse punctures on tergum 2.

4a. Terga 5 and 6 with dark, chocolate-brown hairs and small lateral tufts of pale erect or suberect hairs.

4b. Terga 5 and 6 with brown hairs medially and with pale hairs in about lateral third (at least on tergum 5).

4c. Terga 5 and 6 with hairs all pale—pale brown to orange medially and ochraceous to white laterally.

The localities from which specimens were taken for the analysis are listed below in lettered groups. Immediately following each letter (corresponding to the lettered pie-graphs on the map) the total number of females available and in condition for this study appears in parentheses.

A. (18) Cresson; Dallas; Denton; Eastland Co.; Hamilton; Highland; Mineral Wells; Rosser; Wills Point; Wolfe City.

B. (32) Cherry Springs; Kerrville.

C. (27) Bexar Co.; Lytle; San Antonio.

D. (21) Del Rio; Devils River; Fort Stockton; Juno; Ozona.

E. (18) Carrizo Springs; Cotula; Laguna; Sabinal; Uvalde.

F. (27) Ben Bolt; Brownsville; Edinburg; Lopeno; San Ygnacio; Zapata Co.

G. (40) Bay City; Goliad; Sinton; Weser.

H. (18) Austin; Cypress Mills; Manor; Taylor.

I. (26) College Station; Brazos Co.; Fedor; Lee Co.; Giddings; Humble; Trinity.

Melissodes (Epimelissodes) petulca petulca Cresson.

Melissodes petulca Cresson, 1878, Proc. Acad. Nat. Sci. Philadelphia, vol. 30, p. 201; Cockerell, 1906, Trans. Amer. Ent. Soc., vol. 32, pp. 86, 92; Cresson, 1916, Mem. Amer. Ent. Soc., vol. 1, p. 127; Graenicher, 1930, Ann. Ent. Soc. Amer., vol. 23, p. 160; Michener, 1947, Amer. Mid. Nat., vol. 38, p. 453.

Melissodes illinoensis Robertson, 1895, Trans. Amer. Ent. Soc., vol. 22, p. 126; 1899, Botanical Gazette, vol. 28, p. 38; 1905, Trans. Amer. Ent. Soc., vol. 31, p. 367; 1914, Ent. News, vol. 25, p. 70; Michener, 1947, Amer. Mid. Nat., vol. 38, p. 453.

Epimelissodes illinoensis, Robertson, 1918, Ent. News, vol. 29, p. 92; 1926, Ecology, vol. 7, p. 380; 1928, Flowers and Insects, p. 8.

Melissodes suffusa, Birkmann, 1899, Ent. News, vol. 10, p. 245 (misidentification); Cockerell, 1906, Ann. Mag. Nat. Hist., ser. 7, vol. 17, p. 360 (misidentification).

This subspecies can be reliably separated from *suffusa* only on the basis of hair color. The females of *petulca* can be distinguished by a combination of two out of three of the following characters: mesoscutal patch of brown hairs extends forward beyond a line at the anterior margins of the tegulae and laterally beyond the parapsidal lines; metasomal tergum 2 with brown hairs extending posteriorly beyond the row of coarse punctures which separates the apical pale band from the basal area at least medially; terga 5 and 6 with mostly dark chocolate-brown hairs, with tufts of pale hairs at extreme sides but these not each equaling one third of the width of the tergum. The males of these subspecies are more

variable and less reliably separated than are the females. Males of *petulca* are typically characterized as follows: with abundant brown hairs on mesoscutum; sternal hairs mostly dark brown; metasomal terga with pale pubescent bands narrower than in *suffusa*.

Female. Structure and color: First metasomal tergum very rarely with more than an extremely narrow hyaline margin; punctures on mesoscutum usually separated by from half to one puncture width in posteromedial area, ground usually very shiny, scarcely shagreened.

Hair: Face and genal areas with pale ochraceous to white hairs, rufescent hairs on vertex behind ocelli, short hairs between lateral ocelli and apices of compound eyes and a few hairs behind ocelli dark brown. Mesoscutal patch of dark brown hairs extending forward beyond a line between anterior margins of tegulae and extending laterally beyond parapsidal lines so that anterior width of patch considerably greater than posterior width; scutellum with large patch of dark brown hairs; propodeum and lateral surfaces of thorax with pale ochraceous hairs; mesoscutal hairs anterior to dark hair patch bright rufescent. First metasomal tergum with long pale hairs in basal half or less and appressed pale hairs at extreme sides; tergum 2 with spatuloplumose hair band usually fused with pale ochraceous apical band at extreme sides, pale ochraceous apical band with irregular anterior margin, usually wider laterally than medially, with brown pubescence extending from interband zone onto apical area at least medially; terga 3 and 4 with narrower apical bands than in *suffusa*, usually equal to less than basal area of brown pubescence medially; terga 5 and 6 with dark chocolate-brown hairs medially and ochraceous tufts laterally, lateral tufts of tergum 5 each equal to less than one third of width of tergum; sternal hairs red to dark brown medially, paler at extreme sides of each sternum, usually darker than in *suffusa*. Legs with ochraceous hairs except rufescent hairs on distitarsi and inner surfaces of basitarsi and brown hairs on outer surfaces of fore basitarsi and basitibial plates.

Male. Structure and color: Much as in female, except usual sexual differences.

Hair: Head with hairs as in female but usually with fewer or no brown hairs at vertex. Mesoscutum usually with square patch of reddish-brown hairs; scutellum with abundant dark hairs; axillae usually with a few brown hairs; tegulae often with brown hairs; pale hairs of thorax white to ochraceous, never bright rufescent on

mesoscutum as in female. First tergum with basal three fifths covered with long pale hairs medially and pale hairs extending to margin laterally; tergum 2 with broad arched apical band of pale pubescence, usually consisting of sparser hairs than in *suffusa,* usually separated from basal spatuloplumose hair band across entire tergum except at extreme sides by brown hairs; terga 3-6 with narrower pale bands than in *suffusa,* narrower than basal area of dark pubescence and often with extremely narrow zone of short brown hairs at margin; terga 6 and 7 with abundant brown hairs at least medially; sternal hairs mostly reddish-brown to brown, usually paler at sides of each sternum and on basal few sterna. Legs with pale ochraceous to white hairs except rufescent on distitarsi and inner surfaces of basitarsi and hind tibae.

Type material. Female lectotype of *petulca* from Georgia at the Academy of Natural Sciences of Philadelphia. Lectotype female of *illinoensis,* here designated (Robertson's coll. no. 14971), and male lectoallotype, here designated (Robertson's coll. no. 14889), of *illinoensis,* from Carlinville, Illinois, July 26 and 13, respectively, 1893, on *Lepachys pinnata,* Charles A. Robertson, in the collection of the Illinois Natural History Survey, Urbana.

Distribution. From eastern Texas northward through eastern Kansas, northeast through Missouri to southern Illinois, eastward through the Gulf States to Florida and northward through the Atlantic States to New Jersey (Fig. 9). This subspecies has been collected from April 10 to September 30, but mainly in June and July. In addition to the type material, 237 females and 257 males were examined from the localities listed below. This list includes localities reported in the literature.

ALABAMA: Citronelle; Decatur; Edgewood; Birmingham; Tuskegee. ARKANSAS: Chessman Ferry; Clinton; Hope; Lewisville. FLORIDA: Cocoplum Beach (near Miami); Key Largo; Larkins; South Miami. GEORGIA: Atlanta; Cusseta; Hogansville; Rockmart; Rome; Stone Mountain. ILLINOIS: Carlinville. INDIANA: South McAlester. KANSAS: Labette Co. (intergrade ?). LOUISIANA: Greenwell Springs; Keatchie; Logansport; New Orleans; Schriever. MISSISSIPPI: Hattiesburg. MISSOURI: Buffalo; Columbia. NEW JERSEY: Camden County. NORTH CAROLINA: Aberdeen; Lake James; Raleigh. OKLAHOMA: * Durant. SOUTH CAROLINA: St. Mathews. TEXAS: * Austin; * Bastrop; * Bay City; * Beeville; * Ben Bolt; * Jim Wells Co.; * Bexar Co.; * Brazos Co.; * Calvert;

* Localities from the eastern part of the zone of intergradation.

* College Station, Brazos Co.; * Columbus; * Cypress Mills, * Dallas; * Denton; * Edna; * Falfurrias; * Fedor, Lee Co.; * Giddings; * Goliad (16 miles E.); * Hallettsville; * Hempstead; * Hillsboro; * Humble; * Lee Co.; * Lytle; * Manor; * Matagorda; * McDade; * New Braunsfels; Paris; * Plano; * Riviera; * Rock Island; *Rosser; * Salada Creek, Bexar Co.; * San Antonio; * Taylor; * Three Rivers; Trinity; Upshure Co.; *Victoria; * Weser; * Willis; Wills Point; Wolfe City.

Flower records. These bees have been collected from flowers of the plants listed below. They appear to prefer Compositae of the tribes Heleniae and Helianthiae in that order. Females have been collected only on *Monarda* and *Pycnanthemum* among the non-Compositae.

Borrichia frutescens, Coreopsis cardaminefolia, Gaillardia sp., *G. pulchella, Gossypium herbaceum, Helenium* sp., *H. tenuifolium, Helianthus* sp., *Lepachys pinnata, Lithospermum canescens, Monarda* sp., *M. citriodora, M. punctata, Pycnanthemum, flexuosum, Pyrrhopappus geiseri, Ratibida columnaris, R. columnifera pulcherrima, Rudbeckia* sp., *R. amplexicaulis, R. bicolor, R. subtomentosa, Verbesina helianthoides.*

Melissodes (Epimelissodes) petulca suffusa Cresson

Melissodes suffusa Cresson, 1878, Proc. Acad. Sci. Philadelphia, vol. 30, p. 203; Fox, 1893, Proc. California Acad. Sci., vol. 2, p. 21; 1894, Proc. California Acad. Sci., vol. 2, p. 118; Cockerell, 1899, Catalogo de las Abejas de Mexico, p. 14; 1906, Trans. Amer. Ent. Soc., vol. 32, pp. 78, 89, 90, 92 (*petulca* subsp.); 1914, Can. Ent., vol. 46, pp. 411, 416; Cresson, 1916, Mem. Amer. Ent. Soc., vol. 1, p. 131; Cockerell, 1923, Can. Ent., vol. 55, p. 80; 1923, Proc. California Acad. Sci., ser. 4, vol. 12, p. 73; 1928, Univ. Colorado Studies, vol. 16, p. 114.

Melissodes townsendi Cockerell, 1896, Entomologist, vol. 29, p. 304 (new synonymy); 1897, Bull. Exp. Stat. New Mexico Coll. Agric. and Mech. Arts, no. 24, p. 28; 1898, Bull. Sci. Labs. Denison Univ., vol. 11, p. 66; 1898, Bull. Univ. New Mexico, vol. 1, p. 66; 1906, Trans. Amer. Ent. Soc., vol. 32, p. 78; 1906, Trans. Amer. Ent. Soc., vol. 32, p. 310.

This paler, western subspecies can be distinguished from *petulca* by the characters listed in the diagnosis of the latter. As in the subspecies *petulca,* the males are more variable than the females and can be identified only with difficulty, especially in and near the zone of intergradation.

Female. Structure and color: First metasomal tergum usually with at least a narrow hyaline apical margin and rarely broadly hyaline, terga 2-4 usually completely dark, occasionally broadly hyaline apically; punctures on mesoscutum usually separated by one

* Localities from the eastern part of the zone of intergradation.

or more puncture widths in posteromedian area, ground dull to moderately shiny, shagreened.

Hair: Face and genal areas with pale ochraceous to white hairs; vertex with ochraceous to pale rufescent hairs, with only a few or no long brown hairs on vertex behind ocelli. Mesoscutal patch of dark brown hairs not extending forward beyond a transverse line at anterior margins of tegulae and usually not reaching such a line, anterior end rounded, anterolateral margins contained within parapsidal lines so that patch is quite oval in shape and not much if any larger than the dark patch on the scutellum; axillae usually with less than 50% of hairs dark brown; tegulae usually with yellow to white hairs, rarely pale brown; hairs of propodeum and lateral surfaces of thorax pale ochraceous to white. First metasomal tergum with long pale ochraceous hairs in basal half or slightly more and with long appressed pale hairs laterally to margin; tergum 2 with spatuloplumose hair band fused with pale apical band at extreme sides, pale apical band of diffuse pubescence with evenly arched anterior margin, usually wider medially than laterally, usually with brown pubescence between apical band and basal pale band but these hairs pale in palest specimens; terga 3 and 4 with apical pale pubescent bands usually equal to or wider than basal areas of brown hairs medially, with dense brown tomentum at extreme bases of terga, in palest specimens this tomentum pale ochraceous to rufescent; terga 5 and 6 with dark hairs medially and with lateral tufts of white hairs which on tergum 5 each equals about one third of width of tergum, no dark hairs in palest specimens but medial hairs pale brown to rufescent; sternal hairs red medially and white laterally and apically. Legs with white to pale ochraceous hairs except for the following: outer surfaces of anterior basitarsi often with pale brown hairs, distitarsi and inner surfaces of basitarsi and hind tibiae with rufescent hairs.

Male. Structure and color: As in female except usual sexual differences; metasomal terga more often broadly hyaline than in female (especially in worn specimens).

Hair: Head with ochraceous to white hairs, without brown hairs on vertex. Mesoscutum with ochraceous to white hairs, often with small posteromedian patch of reddish-brown hairs; scutellum usually with median patch of brown hairs fringed with ochraceous hairs; axillae without brown hairs; propodeum and lateral surfaces of thorax with pale ochraceous to white hairs. First metasomal tergum with pale ochraceous hairs over basal three fifths to four fifths

medially and reaching margin laterally; tergum 2 with pale apical band usually fused with basal spatuloplumose band across entire tergum, or at least across median third of tergum, area of brown hairs between these two bands being reduced to lateral oval spots, rarely connected medially, often entirely absent; terga 3-5 with wide apical pale bands which on tergum 3 usually equals basal area of brown hairs medially, occasionally with extremely narrow zone of apical brown hairs (one or two hairs wide); terga 6 and 7 with few or no brown hairs medially, but these usually rufescent, with white or pale ochraceous hairs laterally and apically. Legs with white to pale ochraceous hairs except rufescent hairs on inner surfaces of basitarsi and hind tibiae.

Remarks. In the west a few specimens of this subspecies approach both *M. sabinensis sabinensis* and *M. s. laterufa* in color. Two out of eight females from Delicias, Chihuahua, collected on July 13, 1947, by C. D. Michener are very pale and much like *sabinensis s. str.* The punctation and the form of the hairs on the metasomal terga place all of these as *M. petulca suffusa.* Of the two females from Carlsbad, New Mexico, collected on July 29, 1953, by the author, one is also very similar to *M. sabinensis s. str.*, but identifiable as *suffusa* on the same basis as the above two specimens. It is worth noting that all three of these females are in a rather worn condition and their extreme paleness can be at least partially attributed to fading with age. A series of four males from Hatch, New Mexico, collected on July 15, 1952, by R. H. and L. D. Beamer, Cheng Liang and the author, and another series of nine males collected by the same persons on the same date near Mesilla, New Mexico, are very badly worn, but presumably were pale individuals with little or no brown pubescence basally on terga 3 to 5 and with rather broad hyaline margins on all of the terga. These are, therefore, superficially very much like *M. sabinensis laterufa.* The male genitalia and hairs of the lateral surfaces of the mesepisterna place these males with *M. petulca suffusa.* Another male collected at Del Rio, Texas, June 22-27, 1899, by H. F. Wickham is also very pale, much less worn than the above mentioned New Mexico specimens and have very broad hyaline margins on the terga, but can also be recognized as a male of *suffusa* by the genitalia and hairs of the mesepisterna. The paler females of *suffusa* from New Mexico and western Texas also resemble closely the females of the Californian subspecies of *sabinensis* in color. However, these can be easily separated by the metasomal punctation which is at a minimum in the Californian specimens.

Type material. Lectotype female and lectoallotype male of *suffusa* from Texas, are in the Academy of Natural Sciences of Philadelphia. Male holotype of *townsendi* collected by C. H. T. Townsend, August, Las Cruces, New Mexico, lost or destroyed.

Distribution. From northern Mexico northwards through New Mexico and eastern Colorado, west to northern Arizona, east to northcentral and southeastern Texas in the south and to northeastern Kansas in the north (Fig. 9). This subspecies has been collected from April 12 to August 20, but mainly in June and July. In addition to the type material, 130 females and 209 males have been examined from the localities listed below. This list includes localities reported in the literature.

ARIZONA: Flagstaff. COLORADO: La Junta; Landaman Creek (S. of Stratton); Two Buttes Reserve. KANSAS: Eureka; Lawrence; Leavenworth; Sherman Co.; Stanton Co.; Sunflower, Douglas Co.; Trego Co.; Wichita. NEW MEXICO: Carlsbad; Elida; Elkins; Garfield; Hatch; Hot Springs; Las Cruces; Mesilla; Portales; Roswell; Santa Fe. TEXAS: Alpine; * Babyhead; Brewster Co. (on Rio Grande River); * Brownsville; * Carrizo Springs; * Cherry Springs; * Cisco; * Cotula; * Cresson; Davis Mountains; Del Rio; Devil's River (near Del Rio); * Eastland Co.; * Edinburg; El Paso; Fort Stockton; * Hamilton; *Hidalgo Co.; * Highland; Juno; * Kerrville; * Laguna (Nueces River); * Lopeno; * Loyal Valley; Marathon; * Mineral Wells; * Ozona; * Sabinal; * San Ygnacio; * Sinton; * Sweetwater; * Uvalde; * Weatherford; White Rose Canyon, Davis Co.; *Wichita Falls; * Zapata Co. CHIHUAHUA: Balleza; Catarinas; Delicias; Huejotitlán; Jiménez (17 and 18 miles W.); Parral; Salaíces. NUEVO LEÓN: Montemorelos; Vallecillo. TAMAULIPAS: Las Norias; San Fernando.

Flower records. As in *M. petulca s. str.*, this subspecies prefers flowers of the Compositae and especially the tribes Heleniae and Helianthiae in that order. The males have been more frequently collected on the non-Compositae than the females.

Aster sp., *Bacharris* sp., *Borrichia frutescens, Chrysopsis hispida, Coreopsis* sp., *Gaillardia* sp., *G. pulchella, G. suavis, Helenium* sp., *H. autumnale, H. microcephalum, Helianthus* sp., *H. annuus, Medicago sativa, Monarda* sp., *M. citriodora, M. punctata, Nepeta cataria, Opuntia* sp., *Phacelia* sp., *Ratibida* sp., *R. columnaris, R. tagetes, Rudbeckia hirta, Sphaeralcea* sp., *Tetragonotheca ludoviciana, Thelesperma megapotamicum.*

* Localities from the zone of intergradation in eastern Texas.

Melissodes (Epimelissodes) sabinensis Cockerell

This species is characterized by being generally paler in color than *petulca.* The females are very difficult to separate from the paler females of *M. petulca suffusa*; however, the lateral raised areas of the interband zone of tergum 2 and of the basal areas of terga 3 and 4 are less punctate in *sabinensis.* The males of *sabinensis* are easily recognized by the area of more abundant long white hairs on the lower lateral surfaces of the mesepisterna and by the differences in the genitalia and hidden sterna as described below. Additional characters which are more or less restricted to each subspecies of *sabinensis* will aid in separating these from *suffusa.*

Female. Structure and color: Integument as in *petulca,* but metasomal terga often broadly hyaline apically. Punctation as in *petulca* except as follows: punctures in posteromedian area of mesoscutum always small, round and separated by less than one puncture width; raised lateral areas of terga 2-4 anterior to the median arched row of coarse punctures which separated the apical diffuse pubescent bands from the basal areas and just mesad of lateral arms of graduli less punctate than in *petulca,* punctures small, extremely shallow and obscured by dense, coarse shagreening or tessellation, sparse large scattered punctures bearing bristle-like hairs distinct, especially on tergum 3, much larger than small, shallow, indistinct punctures bearing plumose hairs.

Hair: On head generally white, vertex usually with ochraceous hairs. Pale hairs of mesoscutum ochraceous to somewhat rufescent, usually with at least a few dark hairs in posteromedian area and with a large patch of brown hairs equal to that on scutellum in darkest subspecies; scutellum with dark brown hairs, fringed with pale ochraceous hairs and with a few appressed ochraceous hairs in middle; lateral surfaces of thorax and propodeum with pale ochraceous to white hairs. First metasomal tergum with long pale hairs basally; apical impunctate area of tergum 1 with appressed hairs more abundant and longer than in *petulca,* about half as long as plumose hairs near margin of tergum 2 and usually white or yellow in color, rarely pale brown; tergum 2 without dark hairs in interband zone, rarely with a few dark hairs present in median third of interband zone; terga 3-5 usually without dark brown hairs in basal areas; thick tomentum at extreme bases of terga 3 and 4 always pale red or ochraceous in color, never dark brown; terga 6 and 7 with pale ochraceous hairs, often somewhat rufescent medially but

never dark brown; sternal hairs red to yellow medially and white laterally and apically. Legs with pale ochraceous to white hairs except rufescent hairs on inner surfaces of tarsi and hind tibiae.

Male. Structure and color: Color generally as in *M. petulca* but clypeus and bases of mandibles usually cream-colored; occasionally clypeus narrowly darkened posteriorly. Minimum length of flagellar segment 1 equals half or slightly less of maximum length of segment 2. Sculpturing as in female; raised lateral areas of terga 2-5 less punctate than in *petulca*; often with smaller, more crowded punctures on lower lateral surfaces of mesepisterna than in *petulca.*

Genitalia as in *petulca.* Sternum 8 as in *petulca* but never with vertical fan of several stout hairs in apical emargination, with no hairs medially at apex or with from one to four weak hairs arranged haphazardly. Sternum 7 as in *petulca* but with lateral excavations of lateral plates equal to at least half of length of plates and usually slightly more (Figs. 55-56).

Hair: On head and thorax generally pale ochraceous to white, paler on face, genal areas and sides of thorax than above; scutellum usually with distinct patch of dark brown hairs with a few shorter median pale hairs; mesoscutum usually with at least a few dark hairs in posteromedian area, often these as well as scutellar hairs all pale. Apical impunctate area of tergum 1 with hairs long, largely simple at least apically, usually pale in color; terga 2-7 with variable hairs, described below for each subspecies; sternal hairs rufescent to yellow medially and white apically and laterally. Legs with white to pale ochraceous hairs except rufescent or yellowish hairs on inner surfaces of tarsi and tibiae.

Geographical variation. The concept of *Melissodes sabinensis* presented here is that of a species with three largely allopatric subspecies (Fig. 10). No intergradation can be recognized at present because of the lack of material from critical areas. Three quite distinct solutions are possible besides the one proposed in this work. First, the three forms could be considered as distinct, but closely allied, species. However, the three forms agree with each other in so many respects that this does not seem likely. Second, the Californian form may be a subspecies of *sabinensis,* or these two forms may be separate species, while *laterufa* may be merely a rather common variant of either *sabinensis* or *suffusa.* This does not appear likely, since at least the males of *laterufa* are quite distinctly more similar to *sabinensis* than to *suffusa,* and *laterufa* appears to be at least largely allopatric with *sabinensis* (if not entirely so).

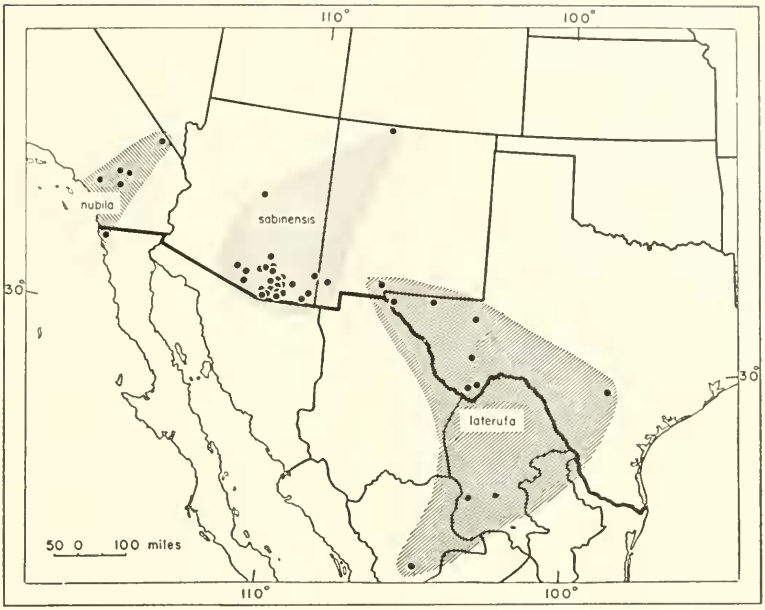

Fig. 10. Map showing the distribution of *M.* (*Epimelissodes*) *sabinensis*. The probable zones of intergradation between the three subspecies are left unshaded since little or nothing is known concerning bees from these areas.

The third possibility is that the California form and *sabinensis* are western subspecies of *petulca,* while *laterufa* is a rather common variant of *suffusa.* This does not appear likely on the same grounds as oppose the second hypothesis and also because of the several common characters which tie the three western forms together and separate them from *petulca.*

The two most likely solutions are, then, that the three forms are distinct species or that they are subspecies of one species. The latter solution has been accepted here because of the apparent similarity of the three forms. Additional collections will undoubtedly resolve this problem in the future.

Melissodes (*Epimelissodes*) *sabinensis laterufa* Cockerell.

Melissodes suffusa var. *laterufa* Cockerell, 1934, Amer. Mus. Nov., no. 697, p. 10.

This subspecies can be separated from *sabinensis s. str.* by its larger average size and by the peculiar hyaline metasomal terga as described below.

Female. Measurements and ratios: N, 12; length, 14-16 mm.; width, 5.5-6.0 mm.; wing length, M = 4.93 ± 0.820 mm.; hooks in hamulus, M = 17.08 ± 0.379; flagellar segment 1/segment 2, M = 2.37 ± 0.089.

Structure and color: Average larger than *sabinensis;* first metasomal tergum medially with apical half (or more) hyaline, clear to yellowish; terga 2-4 with almost entire exposed areas hyaline, clear to yellowish; metasomal punctation as in species description, usually somewhat more coarsely punctate than in *sabinensis s. str.*

Hair: Generally pale ochraceous or white hair and pubescence; mesoscutal patch of dark brown hairs absent or much reduced; metasomal terga without dark brown hairs; sternal hairs yellowish-red to white.

Male. Measurements and ratios: N, 14; length 12-15 mm.; width, 4.5-6.0 mm.; wing length, M = 4.60 ± 0.370 mm.; hooks in hamulus, M = 15.29 ± 0.245; flagellar segment 2/segment 1, M = 2.38 ± 0.035.

Structure and color: As in female, first metasomal tergum broadly hyaline, medially hyaline area covers at least half of tergum; terga 2-5 with broadly hyaline margins as in female; punctation as in female, but usually somewhat coarser.

Hair: As in female, pubescence generally white or ochraceous; mesoscutal patch of dark hairs reduced or absent; metasomal terga without brown hairs, but pubescence bright rufescent on at least one specimen; sternal hairs rufescent to yellow medially, white apically and laterally.

Remarks. Two male specimens from Baboquivari Mts., Arizona, collected on August 15, 1923, by C. L. Fox, and on August 15, 1924, by O. C. Poling, are well within the range of *sabinensis s. str.* but are typically *laterufa* in character. However, these are rather well worn specimens and they are perhaps large males of *sabinensis* which have become faded with age. A single male is known from New Mexico. One of two males collected six miles west of Governor Springs, Big Bend National Park, Texas, on July 16, 1950, by Ray F. Smith, is typically *sabinensis,* except for its large size, and the other is typically *laterufa.* These specimens suggest that *laterufa* may well be a distinct species. However, considering the scarceness of material representing *laterufa* and the great variability of specimens in other forms of *Epimelissodes,* the author is inclined to discount these specimens until further collections can be made.

Type material. Holotype female from Bexar Co., Texas, October

11, 1932, H. B. Parks, in the American Museum of Natural History, New York City.

Distribution. Southern New Mexico and Texas and northern Mexico to southwestern Arizona(?) (Fig. 10). In addition to the holotype, 12 females and 14 males have been examined from the localities listed below. This subspecies has been collected from July 7 to October 11.

Arizona: Baboquivari Mts. (?). New Mexico: Las Cruces. Texas: Bexar Co.; El Paso; Chisos Mts., Big Bend National Park; Governor Springs, Big Bend National Park; Marathon; Pecos River; Pine Springs, Culberson Co. Coahuila: Guadelupe; San Pedro de Colonias. Durango: San Juan del Río.

Melissodes (Epimelissodes) sabinensis sabinensis Cockerell.

Melissodes sabinensis Cockerell, 1924, Amer. Mus. Nov., no. 113, p. 1.

This subspecies is characterized by having the same metasomal punctation as in *laterufa,* or slightly less punctate, but lacking the broadly hyaline margins of the terga of the latter. Both sexes are on the average smaller than either *laterufa* or *nubila.* The males have an entirely pale clypeus and lack the reddish-brown hairs on the margins of the terga which are characteristic of *nubila.*

Female. Measurements and ratios: N, 20; length, 11-14 mm.; width, 4-5 mm.; wing length, $M = 4.21 \pm 0.170$ mm.; hooks in hamulus, $M = 14.90 \pm 0.191$; flagellar segment 1/segment 2, $M = 2.37 \pm 0.033$.

Structure and color: Punctures in raised areas of terga 2-4 as in *laterufa,* slightly more punctate than in *nubila;* margins of metasomal terga usually not broadly hyaline as in *laterufa,* margin of tergum 1 usually narrowly hyaline and occasionally tergal margins somewhat faded and reddish-brown to bright red, but never clear or yellowish as in *laterufa.*

Hair: Rarely with large rectangular mesoscutal patch of brown hairs and, if present, shorter hairs in middle of dark patch ochraceous; large scutellar patch of dark brown hairs with shorter appressed ochraceous hairs medially as in *laterufa;* pale hairs of mesoscutum ochraceous to white, never bright rufescent as in *petulca.* Metasoma without dark brown hairs; basal areas of terga 3-4 with pale ochraceous to golden-brown hairs; extreme bases of terga 3-4 with white to pale orange tomentum; sternal hairs ochraceous to white. Legs with pale ochraceous to white hairs except yellow or rufescent on inner surfaces of tarsi and hind tibiae.

Male. Measurements and ratios: N, 20; length, 10-13 mm.; width, 3-5 mm.; wing length, M = 3.87 ± 0.223 mm.; hooks in hamulus, M = 13.60 ± 0.234; flagellar segment 2/segment 1, M = 2.31 ± 0.035.

Structure and color: Size and punctation as in female; clypeus all cream-colored as in *laterufa;* without broadly hyaline margins on metasomal terga.

Hair: Mesoscutum often without brown hairs, but often with at least a few reddish-brown hairs in posteromedian area; metasomal terga without brown hairs apically, or rarely with a few reddish-brown hairs present at extreme apices of terga 3-5 (one or two apical rows of brown hairs in medial half of tergum); hairs of basal areas of terga 3-5 usually ochraceous or white, occasionally pale golden-brown.

Type material. Holotype male from the Sabino Basin, Santa Catalina Mountains, Arizona, July 8-20, 1916, F. E. Lutz, in the American Museum of Natural History, New York City.

Distribution. Southwestern Arizona and western New Mexico (Fig. 10). These bees have been collected from April 4 to October 1, but mainly in July and August. In addition to the holotype, 36 females and 109 males have been examined from the localities listed below.

ARIZONA: Benson; Bisbee (12 miles W.); Carr Canyon, Huachuca Mts.; Cochise Co.; Douglas; Harshaw; Kits Peak, Baboquivari Mts.; Lee Siding, Pedregosa Mts.; Mescal; Mogollon Rim; Nogales; Oracle; Patagonia; Pearce; Pepper Sauce Canyon, Santa Catalina Mts.; Quijotoa (30 miles E.); Pima Co.; Ramsay Canyon, Huachuca Mts.; Roble's Pass, Tucson Mts.; Sabino Basin, Santa Catalina Mts.; San Carlos; San Simon; Santa Catalina Mts.; Santa Cruz Co.; Santa Cruz Village, Comobabi Mts.; Santa Rita Mts.; Tucson; Tombstone; Turner. NEW MEXICO: Lisbon; Willow Creek, Rio Arriba County.

Flower records. Acacia sp., *Dalea albiflora, Happlopappus* sp., *Heterotheca* sp., *Isocoma* sp., *Kallstroemia grandiflora, Petalostemum* sp., *Psilostrophe cooperi, Sida diffusa, Sphaeralcea* sp., *Verbesina,* sp.

Melissodes (*Epimelissodes*) *sabinensis nubila,* n. subsp.

The males of this subspecies are easily separated from those of both *sabinensis* and *laterufa* by either the presence of brown or reddish-brown hairs apically on metasomal terga 2-5 or by the obfus-

cated posterolateral angles of the clypeus or both. Both sexes often have reddish-brown hairs basal to the apical pale bands on terga 3 and 4 and occasionally on tergum 2. The lateral raised areas of terga 2-4 of both sexes are less punctate than in either of the other two subspecies. The females usually have a large square mesoscutal patch of dark brown hairs. In color and size the females closely resemble *M. petulca suffusa*, whereas the males resemble certain pale members of the *obliqua* group.

Female. Measurements and ratios: N, 9; length, 13-14 mm.; width, 5.0-5.5 mm.; wing length, M = 4.65 ± 0.276 mm.; hooks in hamulus, M = 16.33 ± 0.471; flagellar segment 1/segment 2, M = 2.29 ± 0.310.

Structure and color: Ground spaces on mesoscutum dulled by dense shagreening; punctures in raised lateral areas of terga 2-4 absent or very much obscured by dense fine tessellation, smaller punctures bearing plumose hairs extremely shallow and indistinct, a few larger punctures bearing the bristlelike hairs present and distinct.

Hair: Face and genal areas with white hairs, pale ochraceous on vertex. Mesoscutum with ochraceous hairs and patch of brown hairs in posteromedian area often rectangular and as large as or larger than dark scutellar hair patch, but usually with ochraceous hairs mixed with the brown anteriorly and laterally; lateral surfaces of thorax and propodeum with white to pale ochraceous hairs. First metasomal tergum with long pale hairs in basal half, long appressed to suberect hairs laterally and short, closely appressed, simple, ochraceous to brown hairs in apical impunctate area; remaining terga with hair pattern as in *sabinensis* but occasionally with brown hairs in basal areas of terga 3-5 and occasionally with brown hairs in median third of narrow zone between spatuloplumose hair band and median arched row of coarse punctures on tergum 2; extreme bases of terga 3 and 4 with thick tomentum pale brown to ochraceous; sternal hairs and hairs of legs as in *sabinensis*.

Male. Measurements and ratios: N, 20; length, 11-16 mm.; width, 3.5-5.0 mm.; wing length, M = 4.16 ± 0.226 mm.; hooks in hamulus, M = 14.45 ± 0.246; flagellar segment 2/segment 1, M = 2.28 ± 0.028.

Structure and color: Extreme posterior margin of clypeus darkened, especially laterally between anterior tentorial pits and subantennal sutures. Sculpturing as in female; ground areas on meso-

scutum dulled by shagreening and punctures in basal raised areas of terga 2-5 indistinct or absent as in female.

Hair: Face and genal areas with white hairs, pale ochraceous to white on vertex. Mesoscutum usually with patch of reddish-brown hairs in posteromedian area, but usually smaller than dark scutellar patch; dorsum of thorax with pale hairs ochraceous to white. Metasoma with hairs and pubescence as in female, but usually with marginal zones of reddish-brown appressed pubescence on terga 2-4, on tergum 2 this dark zone occasionally equal to pale portion of apical pubescent band in width; basal areas of terga 3-5 usually with dark brown to reddish-brown hairs; sternal hairs mostly white or pale ochraceous.

Type material. Male holotype collected on *Helianthus annuus* on July 8, 1927, at Riverside, California, by P. H. Timberlake. Female allotype collected on *Gutierrezia sarothrae* on July 25, 1929, at Riverside, California, by P. H. Timberlake. Seven female and forty five male paratypes were collected at Riverside, California, by P. H. Timberlake as follows: September 25, 1924, 1 male on *Encelia farinosa*; August 14, 1925, 1 female on *Heterotheca grandiflora*; July 22, 1927, 4 males on *Senecio douglasii*; July 25 and 26, 1927, 7 males on *S. douglasii*, 1 male on *Gutierrezia sarothrae*; August 3, 1927, 1 male on *G. sarothrae*, 2 males on *S. douglasii*; August 11, 1927, 1 male on *S. douglasii*; July 5, 1928, 1 male on *G. sarothrae*; July 12, 1928, 1 male on *G. sarothrae*; July 17, 1928, 6 males on *Chrysanthemum segetum*, 2 males on *S. douglasii*; July 18, 1928, 1 male on *G. sarothrae*; July 19, 1928, 1 male on *C. segetum*; July 20, 1928, 2 males on *Corethrogyne filaginifolia*, 1 female on *G. sarothrae*; July 26, 1928, 1 female on *G. sarothrae*; July 11, 1929, 2 females on *G. sarothrae*; July 22, 1929, 1 male resting in shade, 1 male on *G. sarothrae*; July 26, 1929, 1 female and 2 males on *Coreopsis lanceolata*; July 12, 1932, 1 male on *Hemizonia paniculata*; September 19, 1932, 1 female on *Stephanomeria exigua*; August 2, 1933, 1 male on *S. douglasii*; September 8, 1933, 1 male on *G. sarothrae*; September 18, 1933, 1 male on *Isocoma vernonioides*; September 11, 1934, 2 males on *G. sarothrae*; August 12, 1936, 1 male on *Gutierrezia californica*; July 28, 1942, 1 male on *I. vernonioides*. Two additional male paratypes were collected by G. E. Bohart at Riverside, California, July 6-7, 1933. The holotype and allotype are in the collection of P. H. Timberlake at the Citrus Experiment Station, Riverside, California. Paratypes are in the collections of the Snow Entomological Museum, the U. S. National

Museum, the American Museum of Natural History, the California Academy of Sciences, the Timberlake collection at Riverside and in the author's personal collection.

In addition to the type material one female was collected in San Bernardino Co., California, by Cocuillett; one male in the Ivanpah Mts., San Bernardino Co., California, by L. M. Marrin on September 5, 1936; one male from Whitewater Canyon, California, September 11, 1935, by P. H. Timberlake on *Bebbia juncea*; and one male from Las Parras, Baja California, Mexico, February, 1922, by W. M. Mann (Fig. 10). A single male bearing the label "Sweetwater River, San Diego Co., Cal. W. J. Chamberlin" is presumably a male of *sabinensis s. str.* Perhaps this specimen was mislabeled and rightly belongs with the short series of males of *sabinensis* collected in the Santa Rita Mts., Arizona, by W. J. Chamberlin which are now before me. The Californian male is identical in every respect with the latter and the labels on all four specimens are of the same type, size and age, although none are dated.

Idiomelissodes, subgenus nov.

Type species. Melissodes duplocincta Cockerell, 1905.

Female. Clypeus very flat in posterior three fifths, or even slightly depressed posteromedially, highest point at about three fifths of length from base, *protruding forward beyond eyes,* but by less than half width of eyes due to great width of eyes, flat area with distinct coarse punctures separated by one to two puncture widths, *ground very shiny, not at all shagreened*; supraclypeal area without or with very few coarse punctures medially, ground very shiny; *eyes large, bulbous, more than twice as wide as genal areas in profile*; galeae smooth and shiny, with sparse, small, scattered punctures, almost twice as long as median length of clypeus; maxillary palpi 4-segmented, fourth segment minute. Mesoscutum, scutellum and sides of thorax coarsely punctate, ground smooth and shiny, scarcely or not at all shagreened; *tegulae oval* with lateral margins evenly rounded, not acuminate anteriorly; metanotum densely punctate in median third, punctures in median area separated by only thin ridges, laterally punctures separated by at least one puncture width; propodeum densely punctate or reticulorugose dorsally, declivous face coarsely punctate but with large impunctate inverted triangle in upper median area, lateral surfaces coarsely punctate posterodorsally and finely punctate anteroventrally, ground moderately shiny, somewhat dulled by shagreening.

Metasoma relatively narrow; pygidial plate V-shaped, rather pointed apically; sterna densely and coarsely punctate. Strigilis with short thin nonpectinate malus; *tibial spurs of middle legs distinctly hooked or sharply curved near tips.*

Hairs generally short; long hairs of mesoscutum rather closely appressed except near margins; *with thick band of white spatuloplumose hairs between mesoscutum and scutellum; basal band on tergum 2 consisting largely of spatuloplumose hairs; anterior face of tergum 1 with spatuloplumose hairs mixed with normally plumose hairs and with long flattened hairs on basal half of dorsal face,* the latter appearing intermediate between the shorter spatuloplumose type and the longer normal plumose type present in this area in other subgenera; scopal hairs white, sparsely plumose, with two to six lateral branches, rachises stout and extending well beyond plumose part of hairs giving the appearance of a layer of simple guard hairs.

Male. Bases of mandibles, labrum and distal half or slightly more of clypeus yellow; *clypeus distinctly protruding from face, flattened posteriorly as in female; eyes bulbous, large,* distinctly converging towards bases of mandibles, *more than twice as wide as genal areas in profile*; antennae long, reaching second metasomal tergum in repose; *maximum length of first flagellar segment equals no more than one third of second segment along same side (dorsal) and usually less*; galeae, maxillary palpi, tegulae and punctation of head and thorax as in female. Metasoma narrow; pygidial plate large, truncate apically and not much wider at base than at apex, notched laterally near apex; sterna coarsely and densely punctate; *fifth sternum with shallow emarginations laterally, long thin hairs arising from near margin of lateral emarginations curve downward in basal three fifths and then bend sharply posteriorly to form a curved row of long hooked hairs overlapping sixth sternum*; last exposed sternum (sixth) rounded apically, with a shallow hairless median groove and two shallow oval impunctate depressed areas laterally near base and beneath hooked hairs of fifth sternum, elsewhere with punctures bearing long hairs directed posteriorly. *Strigilis with long malus which reaches or almost reaches distal tip of fore basitarsus, pectinate; middle tibial spurs hooked near tips; fore basitarsi slightly twisted, inner surface distal to emargination of strigilis divided into two distinct halves—basal half densely set with long, thin, slightly flat-tipped hairs and distal half which is smoothly depressed, thinner, impunctate, mostly hair-*

less and bears a small tuft of ten to twelve stout, flat-tipped hairs about half as long as those in basal half; inner surfaces of hind basitarsi with long triangular apical impunctate shiny area bordered posteriorly by a dense row of short highly plumose weak hairs and anteriorly by an oblique row of simple stout hairs as elsewhere on inner surface, these hairs of inner surface become much longer apically and along anterior border of basitarsus. *Distribution of spatuloplumose hairs as in female. Seventh metasomal tergum without lateral teeth*; lateral teeth present on sixth tergum.

Genitalia distinctive, relatively large. *Gonostylus exceedingly thin, long, slightly capitate, attached to gonocoxite ventrally,* bearing a small tuft of hairs at tip and a few along shaft. *Gonocoxite produced dorsally and apically into a long, stout, incurved, truncate process almost half as long as gonostylus; spatha as long as wide or longer,* slightly emarginate medially at apex and *constricted about half distance from apex to base; penis valve very much enlarged,* with sharp apical process directed laterally, rather membranous with several indistinct longitudinal folds dorsally and ventrally, lateral process short and blunt, *ventral surface just below apical process with a large oval pad which is somewhat narrowed distally and covered with minute transverse striations,* with very long, weak hairs directed laterally from lateral surface of valve below lateral process. *Sternum 7 with lateral plates not emarginate laterally* but with strong median apical processes directed posteriorly; with two small median plates without hairs. Sternum 8 with lateral apodemes extremely short and thick, as wide as one fourth of length of sternum or wider, and center of lateral apodemes lie immediately below center of sternum; pointed apically, with strong apically directed, longitudinal ventral, median carina.

Melissodes (Epimelissodes) duplocincta Cockerell.

Melissodes duplocincta Cockerell, 1905, Pysche, vol. 12, p. 103; 1906, Trans. Amer. Ent. Soc., vol. 32, pp. 78, 88; Snow, 1906, Trans. Kansas Acad. Sci., vol. 20, p. 137.

Female. Measurements and ratios: N, 20; length, 10-12 mm.; width, 3.5-4.5 mm.; wing length, $M = 3.52 \pm 0.164$ mm.; hooks in hamulus, $M = 12.45 \pm 0.135$; flagellar segment 1/segment 2, $M = 1.87 \pm 0.022$.

Structure and color: Integument generally black; distitarsi, apex of first metasomal tergum and lower surfaces of flagella rufescent; in palest specimens metasomal terga 1 and 2, legs, sterna, apex of propodeum, median areas of scutellum and mesoscutum, metepi-

sterna and posterior part of mesepisterna, bases of mandibles, labrum and clypeus all red or brownish-red. Punctures in posterior half of clypeus round, separated by one to two puncture widths; maxillary palpal segments in ratio of about 4:2:2:1. Punctures in posteromedian area of mesoscutum separated mostly by one or more puncture widths, small, round; lateral faces of mesepisterna and scutellum with punctures of same size as on mesoscutum, but more crowded. Basal half of dorsal face of first metasomal tergum with small round distinct punctures with shiny bottoms and separated by half to one puncture width, apical area impunctate, ground moderately shiny, delicately shagreened; terga 2-4 with extremely small but distinct punctures separated by about one puncture width beneath pale pubescent bands, in basal areas of black hairs punctures of same size but sparser medially and more crowded laterally in raised areas.

Hair: On head white except a few long pale grayish-brown hairs on vertex. Thoracic hairs white except black hairs on scutellum and pale grayish-brown hairs mixed with the white over most of mesoscutum producing a curious mottled or streaked appearance. First tergum with long white hairs in basal half and laterally, leaving a rectangular apical area which is hairless medially but with short, closely appressed, black hairs in lateral thirds or less; tergum 2 with white basal spatuloplumose bands connected at extreme sides with broad white distal pubescent band which is of about same width across entire tergum, with short, dark brown to black, suberect hairs in interband zone and this dark area medially equal in width to less than half of and laterally to three fourths or more of apical band, with a fringe of short dark brown hairs on margin across most of tergum; tergum 3 similar to tergum 2 but without basal white band and apical band slightly wider than that on tergum 2; tergum 4 similar to tergum 3 but pale band even wider and without apical fringe of dark hairs except in median fifth or less; terga 5 and 6 with dark brown to black hairs, tufts of white hairs laterally on tergum 5; sternal hairs dark brown to reddish-brown. Legs with white hairs except the following: fore tarsi pale brown, inner surfaces of fore and middle tibiae and middle tarsi pale brown; inner surfaces of hind basitarsi and basitibial plates dark brown.

Male. Measurements and ratios: N, 20; length, 10-12 mm.; width, 3-4 mm.; wing length, $M = 3.41 \pm 0.221$ mm.; hooks in hamulus, $M = 11.45 \pm 0.114$; flagellar segment 2/segment 1, $M = 4.44 \pm 0.069$.

Structure and color: Integumental color as in female; labrum pale yellow; bases of mandibles and trilobed macula covering anterior half or somewhat more of clypeus bright yellow; flagella yellow or orange below except first and last segments, brownish-red above; wings as in female. Laterodorsal surfaces of last four or five flagellar segments with longitudinal impunctate shallow grooves or flattened depressed areas; maxillary palpi and galeae as in female; punctation of head, thorax and metasoma as in female. Genitalia as in subgeneric description (Figs. 58-61).

Hair: On head and thorax as in female, but without pale grayish-brown hairs on vertex of head and area of mottled hairs of mesoscutum less extensive (not extending forward beyond a transverse line at anterior margins of tegulae). Basal area of white hairs on tergum 1 covers more than half of tergum medially and apical rectangular area covered with short appressed black hairs arising from small distinct punctures; distal white pubescent bands on terga 2-5 equal to one another in width, that on tergum 2 about equal to basal area of black hairs laterally and not much wider than apical fringe of black hairs medially; apical fringe of dark hairs narrower on terga 3 and 4 and absent or reduced to less than one fifth of width of tergum on tergum 5; hairs of last two terga dark brown with small tufts of white hairs laterally on tergum 6; hairs of sterna reddish-brown to black. Legs with white hairs except red or yellowish-red on inner surfaces of tarsi and fore tibiae.

Type material. Lectotype male, here designated, and lectoallotype female, here designated, from Bill William's Fork, Arizona, August, F. H. Snow, are in the Snow Entomological Museum at the University of Kansas.

Distribution. This is a rather widespread, but relatively rare, desert species of extreme southern California, southern Arizona and northern Mexico (Fig. 3). This species has been collected from June 15 to August 23. Including the type material, 30 females and 31 males have been examined from localities listed below.

Arizona: Bill William's Fork; Black Dike Prospect, Sierrita Mts.; Buckeye; Madera Canyon, Santa Catalina Mts.; Oracle (5 miles W.); Phoenix; Santa Rita Mts.; Tucson. California: Colorado Desert. Chihuahua: Camargo (20 miles S. W.); La Cruz. Coahuila: Guadelupe; Paila.

Flower records. This species seemingly does not visit composites. However, the flower records are too meager to infer any definite

conclusions regarding flower preferences. Males have been collected on *Cevalia sinuata, Eriogonum* sp., *Gossypium herbaceum* and *Sphaeralcea* sp., and females have been taken on *Cevalia sinuata* and *Echinocactus* sp.

Subgenus MELISSODES Latreille

Melissodes Latreille, 1829, *in* Cuvier, Le Règne Animal, ed. 2, vol. 5, p. 354 (no species included); Romand, 1841, *in* Guérin, Mag. Zool., ser. 2, ann. 3, p. 5, pl. 70; Blanchard, 1849, *in* Cuvier, Le Règne Animal, (ed. 3), insectes, vol. 2, p. 216, atlas pl. 128 *bis*, fig. 4; Cresson, 1878, Trans. Amer. Ent. Soc., vol. 7, pp. 224-226; Ashmead, 1899, Trans. Amer. Ent. Soc., vol. 26, pp. 62, 63; Cockerell, 1901, Ann. Mag. Nat. Hist., ser. 7, vol. 7, p. 49; 1906, Trans. Amer. Ent. Soc., vol. 32, pp. 74-93, 102-104, 107-114; Robertson, 1905, Trans. Amer. Ent. Soc., vol. 31, p. 365; Cockerell, 1910, Univ. Colorado Studies, vol. 7, pp. 184, 193; 1911, Proc. U. S. National Museum, vol. 43, pp. 262, 267; Viereck, 1916, Connecticut Geol. Nat. Hist. Surv. Bull., no. 22, p. 730; Cockerell, 1918, Trans. Amer. Ent. Soc., vol. 44, pp. 29-31; Lutz and Cockerell, 1920, Bull. Amer. Mus. Nat. Hist., vol. 42, pp. 595-614.

Type species. Melissodes leprieuri Blanchard, 1849 (first recognizable included species).

Female. Small to medium-sized bees; color various, but rarely with metallic reflections on metasomal terga. Clypeus relatively flat to slightly protuberant, never protruding beyond face as much as half of width of eye in profile, rising gradually from plane of supraclypeal area, not forming a distinct step from supraclypeal area to a flattened clypeal plane; *galea smooth and shiny, sparsely punctate above, ground rarely delicately shagreened above, but usually somewhat dulled at tip;* maxillary palpi 4-segmented, fourth segment always shortest and second segment usually longest; minimum length of second flagellar segment usually less than apical width, occasionally as long as wide, but never longer, always slightly shorter than third segment; eyes always more than one third as wide as long and less than half as wide as long in facial view, converging towards mandibles, wider than genal area in profile. Thorax variously sculptured, but *dorsal face of propodeum always with discrete punctures in at least apical half and usually with ground areas shiny or moderately so,* finely tessellate or shagreened; *metanotum as long medially as dorsal face of propodeum and usually longer; tegulae acuminate anteriorly, lateral margins concave or straight in anterior third or more,* each tegula thus in two portions, a flat, narrow, anterior section and a bulbous, wide, posterior section. Terga variously sculptured; first tergum usually half as long as greatest width, occasionally shorter and often longer.

Thorax never with spatuloplumose hairs. First tergum with long plumose hairs basally, short appressed or subappressed, relatively

simple hairs apically; *tergum 2 rarely with spatuloplumose hairs in basal pubescent band and, when these are present, the spatulate tips are narrower than in Epimelissodes,* with basal and distal bands separated by a more or less narrow zone of suberect to appressed, simple hairs, *distal pale band never reaches apical margin of tergum except rarely at extreme sides,* apical area with short, suberect to appressed, simple hairs, *distal band usually not interrupted medially except by wear, of approximately the same width across tergum (not abruptly notched medially along posterior margin); tergum 3 with a usually broad pubescent band separated from apex across entire tergum except occasionally at extreme sides,* apical area as in tergum 2; tergum 4 with a broad apical pale pubescent band often interrupted medially by a patch of suberect simple hairs. *Inner surfaces of hind basitarsi usually with yellow to dark red hairs*; scopal hairs usually pale, highly plumose.

Male. Labrum usually all pale colored, occasionally with a narrow brown margin; clypeus yellow; mandibles usually with broad basal yellow spots. Clypeus never protruding from face by as much as half of width of eye in profile, arising gradually from plane of supraclypeal area; *galeae smooth and shiny,* not dulled by tessellation or shagreening except at tips; maxillary palpi as in female, rarely with a minute fifth segment; *minimum length of first flagellar segment equals one third to one tenth of maximum length of second segment,* usually about one sixth as long as second segment; antennae long to moderately long, reaching at least to first metasomal tergum and usually to apex or beyond; eyes less than half as wide as long in facial view, converging towards mandibles. Structural characters of thorax and metasoma as in female with the following additions: tergum 7, as well as 6 and usually 5, with short apical spines on each side; pygidial plate always notched a little before apex on each side, usually longer than basal width; last exposed sternum subtriangular, truncate apically but not sharply so, shallowly grooved medially, bare or almost so.

Genitalia and hidden sterna are distinctive; *gonocoxite with dorsal carina not produced dorsally and inwards to form an obtuse process; gonostylus* short, equal to half length of gonocoxite, often somewhat capitate, with abundant, often long, simple hairs on outer surface, *never twice as wide near base as near apex. Sternum 7 with lateral plate large, testaceous and without a sharp, laterally directed, apical process, apex rounded, directed apically or slightly laterally, well separated from median plate; median*

plate completely devoid of hairs, relatively small, curved ventrally to form an oblique, scroll-like or partial-cylinderlike structure, occasionally reduced to a small simple structure curved ventrally and well separated from base of median emargination, often with ventral fold of scroll flattened and greatly expanded to resemble superficially the large transparent plate of *Eumelissodes* and *Ecplectica,* but the hairlessness and the derivation from the oblique, scroll-like plate is obvious. Sternum 8 with a long median ventral keellike carina which may be expanded at apex; usually with apical hairs; apex not truncate as in *Epimelissodes.*

Hair pattern as in female with the following additions: tergum 4 with pubescent band similar to that of tergum 3 but closer to apical margin; tergum 5 usually with apical band similar to that on tergum 4 of female, but narrower and often interrupted medially or absent; *terga 6 and 7 with brown to black, long, appressed hairs at least medially.*

Remarks. Melissodes fonscolombei Romand, 1841, is considered to be a *nomen dubium,* hence unavailable for taxonomic purposes. *M. leprieuri* Blanchard then becomes the first species included in this genus. The reasons for considering *fonscolombei* as a *nomen dubium* have been outlined in a note sent to the secretary of the International Commission on Zoological Nomenclature to be published in the Bulletin of Zoological Nomenclature.

In order not to be repetitious, the first description below, that of *M. communis,* is relatively more detailed than those following. This species will serve as a model with which to compare subsequently described forms. Additional characters of the subgenus, mostly negative, are included in the key to the subgenera of *Melissodes* given above.

There are certain species groups within the subgenus *Melissodes* which are characterized by similarities in the male genitalia and hidden sterna and to some extent in punctation and/or color pattern. The species involved in these groups are often extremely similar and difficult to separate. Some of these could justifiably be termed sibling species. A stable character in one or more species often becomes quite variable in another species. This occurs with most of the characters employed as specific characters. There is considerable geographic variation also complicating the situation. Often this variation in one species is paralleled in one or more additional species. For these reasons the keys provided to separate these species are less reliable than usual and one must depend a great deal

on the detailed descriptions and particularly on the discussions of variation provided with each description. The groups mentioned above are often not distinct and grade into one another and, therefore, are not named here. The relationships of the various species can be inferred from their arrangement below and from statements in the text.

The key to species given below includes the two species of the subgenus *Ecplectica* which occur within the region covered by this revision. The key to the males is especially difficult to use and a few couplets probably will cause a certain amount of misidentification. Several species, however, can be recognized readily by certain characters of the terminalia (*tessellata, raphaelis, trifasciata, rufodentata, tepaneca, gilensis, paroselae*). Since identification of some of these species depends upon the terminalia and since the most troublesome couplets in the key involve separating certain of these from the remaining species, the author feels that all males belonging to these subgenera should be dissected by anyone not thoroughly familiar with these groups. To facilitate identification of the males, the several species listed above can be removed from the key to the males given below and readily identified by means of the short key which follows immediately below.

1. Gonostylus very short, less than half as long as gonocoxite, twice as broad basally as near apex or broader in lateral view, not capitate; median plate of sternum 7 relatively small, with several short hairs on ventral surface (Figs. 104-106) (to couplet 7 of the key to males given below). ..... *Ecplectica*

   Gonostylus usually as long as or longer than half length of gonocoxite, not twice as wide basally as near apex in lateral view, often somewhat capitate; median plate of sternum 7 without hairs ventrally 2

2(1). Sternum 7 with median plate reduced to a small process curved ventrally and separated from middle of median emargination of the sternum by twice the length of the plate or more (Fig. 89) (to couplet 26 of the key to males given below).

   Sternum 7 with median plate large, curled or folded ventrally and forming an oblique scroll-like structure separated from middle of median emargination by the length of the plate or less, *or* expanded into large flattened plates 3

3(2). Mesoscutum, scutellum and mesepisterna with ground areas dulled by dense, regular tessellations; sternum 7 with median plate bidentate apically (Fig. 102). ..... *tessellata*

   Mesoscutum, scutellum and mesepisternum with ground areas smooth and shiny or somewhat dulled by shagreening or irregular tessellation; sternum 7 with median plate variously formed, not bidentate apically 4

4(3). Sternum 7 with median plate flattened and expanded so that medially it is as broad as or broader than lateral plate at the same level, *if* slightly narrower, *then either* apex of plate bent dorsally *or* apex of gonocoxite separated from apex of its dorsal carina by one third length of gonostylus or more (Figs. 94, 97, 98) 5

Sternum 7 with median plate in the form of elongate, oblique, scroll-like structure which may be slightly flattened ventrally, but ventral fold of "scroll" never as wide medially as lateral plate at the same level, tip of plate not bent dorsally; gonocoxite with apex not far removed from apex of its dorsal carina (to couplet 2 of the key to males given below, omitting all couplets ending with the species referred to in this key).

5(4). First flagellar segment very short, minimum length equals one eighth or less of maximum length of second segment and scarcely, if any, longer than pedicle ..... *paroselae*

First flagellar segment longer, minimum length equals about one fifth of maximum length of second segment, often longer and never shorter than one seventh of second segment, distinctly longer than pedicle 6

6(5). Medium-sized bees; tergum 2 with interband zone distinctly punctate; sternum 7 with median plate bent dorsally at tips and with inner apical margin curved, apex rounded (Fig. 94). *gilensis*

Small bees; tergum 2 with interband zone obscurely punctate; sternum 7 with flattened ventral surfaces obliquely rhomboidal in outline, tips not bent dorsally and not rounded (Fig. 97). *blanda*

KEY TO THE SPECIES OF THE SUBGENERA ECPLECTICA AND MELISSODES

MALES

1. Mesoscutum with small shallow punctures separated by one to two puncture widths anteriorly and two to four puncture widths in posteromedian area; mesoscutum, scutellum and mesepisternum with dense regular tessellations completely dulling surfaces ..... *tessellata*

Mesoscutum with punctures usually deeper, larger and more crowded; mesoscutum, scutellum and mesepisternum without dense regular tessellation dulling surfaces, occasionally shagreened or irregularly tessellate in one or more of these areas, but not regularly so in all of them 2

2(1). Metasomal hairs and pubescence all black or with bands of pale pubescence interrupted medially on all terga, except, perhaps, the third; mesepisternal hairs all or almost all dark brown to black 3

Metasomal hairs and pubescence forming complete bands of pale pubescence on at least two terga, *if* all pale bands interrupted medially, *then* mesepisternal hairs all pale, except for a few brown hairs in lower posterior angles 5

3(2). Head with white hairs at least surrounding antennal fossae and usually all or almost all hairs of head white; mesoscutum often with sparse white hairs laterally and anteriorly; terga 2 to 5 usually with at least a few white hairs laterally 4

Hairs of head, mesoscutum and terga all black ..... *leprieuri*

4(3). Terga 2 and 3 with sparse but distinct punctures separated by one or more puncture widths in basal half or less of apical areas, these punctures about equal in diameter to those of basal areas of terga; wing membranes somewhat infumate, yellowish (Mexico) ..... *labiatarum*

Terga 2 and 3 with abundant punctures separated by one puncture width or less in basal three fifths of apical areas (especially laterally), punctures distinctly smaller than those of basal areas of terga; wing membranes usually deeply infumate, brown (United States) ..... *bimaculata*

5(2). Tergum 2 with distal pale band absent or interrupted medially 6

Tergum 2 with distal pale band complete, interrupted medially only in worn specimens and then former presence indicated by crowded row of punctures 12

6(5). Gonostylus very short, less than half as long as gonocoxite, in lateral view twice as broad near base as near apex, not capitate; median plate of sternum 7 relatively small, with several short hairs on ventral surface (*Ecplectica*) 7

Gonostylus usually as long as half length of gonocoxite or longer, not twice as wide basally as near apex in lateral view, often somewhat capitate; median plate of sternum 7 without hairs ventrally 8

7(6). Tergum 2 with distal pale band absent; mandibles often without basal yellow spots or these reduced in size; tergum 3 with apical area with small indistinct punctures basally . *trifasciata*

Tergum 2 with distal pale band present but interrupted medially; mandibles with large yellow basal spots; tergum 3 with apical area coarsely punctate basally ..... *raphaelis*

8(6). Tergum 2 with distal pale band reduced to short lateral fasciae equal in length to one third or less of width of tergum; legs with sparse, weak hairs; outer surfaces of hind tibiae with hairs weakly plumose, not hiding surfaces, median third with punctures bearing hairs separated from their nearest neighbors above and below by two to four puncture widths or more. *foxi*

Tergum 2 usually with distal pale band only narrowly interrupted medially, lateral fasciae usually equal to more than one third of width of tergum; legs with hairs abundant; outer surfaces of hind tibiae effectively hidden by long, highly plumose hairs, median third with punctures bearing hairs separated above and below mostly by one puncture width or less 9

9(8). Terga 2 and 3 with apical areas densely punctate, punctures separated mostly by one puncture width, often by less and occasionally by more, but rarely by more than two puncture widths (Texas) ..... *maesta*

Terga 2 and 3 with apical areas impunctate or with punctures separated mostly by two or more puncture widths 10

10(9). Tergum 4 with pale pubescent band reaching apical margin laterally, strongly notched medially along posterior margin; tergum 5 with a complete or narrowly interrupted pale band; hairs of head and thorax ferruginous, pale metasomal bands white (Mexico) . . . . . *elusa*

Tergum 4 with pale pubescent bands separated from apical margin across entire tergum; tergum 5 with pale pubescence absent or restricted to lateral fasciae equal to one third or less of width of tergum; hairs of head and thorax white or pale ochraceous, or, *if* ferruginous, *then* pale metasomal bands also ferruginous 11

11(10). Head and thorax with pale hairs white to pale ochraceous; terga with pubescent bands white; tegulae dark brown to black (Mexico) . . . . . *labiatarum*

Head and thorax with pale hairs ferruginous; terga with pale pubescent bands ferruginous; tegulae red to reddish-brown (Cuba) . . . . . *cubensis*

12(5). Minimum length of first flagellar segment equals one sixth of maximum length of second segment or more, occasionally slightly less, but *if* equal to as little as one seventh of second segment, *then* terga 2 and 3 with apical areas impunctate or with minute punctures equal to less than two times basal width of hairs arising from them 13

Minimum length of first flagellar segment equals less than one sixth of maximum length of second segment, usually one seventh or less, *if* as long as one sixth, *then* terga 2 and 3 with distinctly punctate apical areas, punctures equal to about three times basal width of hairs arising from them 21

13(12). Tergum 2 with broad distal band equal to apical area medially or almost so; tergum 4 with broad pale band equal to four times apical area medially or more 14

Tergum 2 with distal band narrow, half as wide as apical area medially or less, or, *if* as wide as apical area or almost so, *then* tergum 4 with pale band distinctly narrower than four times apical area medially 15

14(13). Medium-sized bees, 10.0-13.0 mm. in length; terga 2-4 with apical areas broadly hyaline, yellow to colorless; tergum 2 with interband zone and terga 2-4 with apical areas with surfaces dulled by fine transverse shagreening; sternum 7 with median plate enlarged, flattened, with tips bent dorsally and with inner margin curved and apices rounded in ventral view (Fig. 94) . . . . . *gilensis*

Small bees, 7.5-11 mm. in length; terga 2-4 with apical areas usually piceous or at least infumate, occasionally colorless, rarely yellow; tergum 2 with interband zone and terga 2-4 with apical areas shiny to moderately so, with transverse shagreening relatively coarse; sternum 7 with median plate forming a slightly flattened, ventral fold, inner margin straight,

transverse or nearly so (forming much more than a 45 degree angle with the vertical), not bent dorsally at tips (Fig. 77). *tepida*

15(13). Hairs of head and thorax very long and weak, lower halves of lateral surfaces of mesepisterna with hairs seen from front considerably longer than third flagellar segment; minimum length of first flagellar segment equals one third to one fourth of longest length of second segment; apical margin labrum brown ..... *flexa*

Hairs of head and thorax shorter, those of lower halves of lateral surfaces of mesepisterna equal to third flagellar segment or less; minimum length of first flagellar segment usually less than one fourth of maximum length of second segment; labrum usually entirely pale in color 16

16(15). Terga 1 to 4 and often 5 with apical areas translucent brownish-yellow to transparent and colorless; tergum 2 with distal band often almost as wide as apical area medially ..... *communis*

Terga 1 to 4 with apical areas opaque dark brown to black; tergum 2 with distal pale band distinctly narrower than apical area medially 17

17(16). Sternum 8 with median plate flattened, broad, ventral surface obliquely rhomboidal in outline; gonocoxite extends posteriorly beyond apex of dorsal carina of gonocoxite by almost half length of gonostylus, dorsal carina of gonocoxite angular (Figs. 96-97); pale pubescent band of tergum 5 complete; with little or no dark hairs on mesonotum or scutellum *blanda*

Sternum 8 with median plate usually not flattened, not rhomboidal in outline ventrally, very narrow; dorsal carina of gonocoxite smoothly rounded, with apex not much separated from apex of gonocoxite (Figs. 69-72); often tergum 5 with pale band interrupted medially or absent; mesoscutum and scutellum often with abundant dark hairs 18

18(17). Tergum 5 with pale band absent or broadly interrupted medially, *if* present and uninterrupted or only narrowly so, *then either* mesoscutum with abundant dark brown hairs posteromedially *or* tergum 2 with median third of interband zone impunctate or with small shallow punctures separated mostly by more than one puncture width and obscured by dense regular shagreening ..... *communis*

Tergum 5 with pale band complete or only narrowly interrupted medially, *if* absent or broadly interrupted, *then* mesoscutum without brown hairs and tergum 2 with median third of interband zone distinctly punctate, punctures separated by one puncture width or less and ground areas moderately shiny, not densely shagreened 19

19(18). Vertex of head with abundant dark brown hairs; mesoscutum with brown hairs posteromedially ..... *martinicensis*

Vertex of head without dark hairs; mesoscutum without dark hairs or with a very small posteromedial patch of brown hairs 20

20(19). Tergal bands white; tergum 5 with pale band complete or very narrowly interrupted ..... *elusa*
Tergal bands ferruginous; tergum 5 with pale band restricted to lateral thirds of tergum or completely absent ..... *cubensis*

21(12). Interband zone of tergum 2 with bristlelike hairs ochraceous, erect or almost so, long and stiff, long pubescence of basal pale band bent upwards by adjacent hairs of interband zone; tergum 2 with hairs of apical area long, ochraceous ..... *panamensis*
Interband zone of tergum 2 with bristlelike hairs usually dark brown at least medially, suberect to subappressed, never so erect and stiff as to bend upwards the adjacent pubescence of the basal pale band; tergum 2 with hairs of apical areas usually brown at least medially 22

22(21). Terga 2 and 3 usually with apical areas (at least basally near pubescent bands) with punctures equal in diameter to three or more times basal width of hairs arising from them; tergum 5 with pale pubescent band absent or broadly interrupted medially; lateral areas of vertex between summits of compound eyes and lateral ocelli with abundant punctures separated mostly by less than one puncture width, ground areas delicately shagreened 23
Terga 2 and 3 with apical areas impunctate or with punctures much less than three times as wide as basal width of hairs arising from them; tergum 5 with pale band complete or very narrowly interrupted medially, *if* absent or broadly interrupted, *then* lateral areas of vertex with small punctures separated mostly by more than one puncture width, ground areas smooth and shiny 24

23(22). Tergum 2 with distal pale band usually equal to half or less of apical area medially, never as broad as three fourths of apical area; mesoscutum with abundant punctures, usually becoming smaller and more crowded posteromedially (United States). ..... *comptoides*
Tergum 2 with distal pale band equal to about three fourths of apical area medially; mesoscutum with punctures becoming slightly sparser posteromedially, or evenly spaced (Bahama Islands) ..... *cestus*

24(22). Minimum length of first flagellar segment rarely equals more than one seventh of maximum length of second segment (and then in a West Indies species); tergum 2 with distal pale band usually half as broad as apical area medially or less, relatively straight across tergum, appearing quite straight in median third and curving posteriorly in lateral thirds or less, apical area medially about twice as broad as apical area laterally 25
Minimum length of first flagellar segment often equals much more than one seventh of maximum length of second segment; tergum 2 with distal pale band much broader than half of apical area medially, *if* narrower than this, *then* considerably broader laterally than medially and/or strongly curved so that pale band reaches apex of tergum at extreme sides, or almost

so, apical area being medially less than twice as wide as apical area laterally 27

25(24). Terga 2-4 with apical areas dulled by very dense, fine, transverse shagreening; minimum length of first flagellar segment equals one eighth or less of maximum length of second segment; sternum 7 with median plate flattened and expanded (Fig. 98). ..... *paroselae*

Terga 2-4 with apical areas moderately shiny, only slightly dulled by fine, transverse shagreening; minimum length of first flagellar segment often equals more than one eighth of second segment; sternum 7 with median plates reduced to small, ventrally curled processes (Fig. 91) 26

26(25). Mesoscutum never with small posteromedian area of small crowded punctures, evenly punctate or posteromedian area sparsely punctate; sternum 8 with apical margin straight or almost so, lateral apodemes with smoothly rounded posterior margins (Fig. 89) (West Indies) ..... *rufodentata*

Mesoscutum usually with small posteromedian area of punctures which are smaller and more crowded than on median flattened area; sternum 8 with apical margin emarginate, lateral apodemes with sinuate posterior margins (Fig. 92); (Southeastern United States to Panamá) ..... *tepaneca*

27(24). Tergum 2 with distal pale band broad, equal to three fourths of apical area medially or more; pale hairs of head and thorax white to pale ochraceous; mesoscutum with posteromedian area impunctate or sparsely punctate ..... *tepida*

Tergum 2 with distal pale band equal to half or less of apical area medially, *if* equal to three fourths of apical area, *then either* pale hairs of head and thorax ferruginous *or* mesoscutum with posteromedian area with punctures as crowded or more crowded than anteriorly, or both 28

28(27). Tergum 5 with pale band absent or broadly interrupted medially, *if* complete or narrowly interrupted, *then* pale band of tergum 4 not sharply notched posteriorly but evenly curved. *thelypodii*

Tergum 5 with pale band complete or very narrowly interrupted; tergum 4 with pale band sharply notched posteromedially, almost cutting the band into two ..... *elusa*

FEMALES

1. Thoracic hairs entirely black or dark brown 2

Thoracic hairs not all black or dark brown, with at least a few pale hairs on posterior lobes of pronotum and usually with pale hairs surrounding wing bases and on propodeum, or thoracic hairs all or largely pale 5

2(1). Tergum 2 with distal pubescent band absent or reduced to short, thin, lateral fasciae of dark brown pubescence less than one third of width of tergum; terga 2 and 3 with apical areas with abundant punctures separated mostly by one to two puncture widths and about equal in diameter to those of basal areas. *bimaculata*

Tergum 2 with distal pubescent band present, complete or narrowly interrupted medially, usually dark brown but often yellowish or white at least laterally; terga 2 and 3 with indistinct, widely separated, small punctures, or with larger punctures separated mostly by more than two puncture widths 3

3(2). Tergum 4 with apical white pubescent band present, often interrupted medially by dark brown hairs; terga 2 and 3 with white pubescent bands often present at least laterally; scopal hairs yellow to pale ochraceous; inner surfaces of hind basitarsi with orange to dark red hairs (United States or Mexico) 4

Tergum 4 without white pubescent band; tergum 3 without pale pubescence; tergum 2 with distal pubescent band usually dark brown, occasionally yellow laterally; scopal hairs usually black or dark brown, occasionally orange medially; inner surfaces of hind basitarsi with black hairs (Cuba) ..... *leprieuri*

4(3). Terga 2 and 3 with apical areas with 2 to 4 irregular rows of sparse, long, simple, dark brown hairs; tergum 2 with distal pubescent band dark brown or brown at least medially (Mexico) ..... *morrilli*

Terga 2 and 3 with apical areas with 6 or more irregular rows of abundant, short, simple, dark brown hairs; tergum 2 with distal white pubescent band complete, unless worn away (United States) ..... *communis*

5(1). Posterior pronotal lobes with abundant dark brown hairs; mesepisterna with abundant dark brown hairs at least on ventral and lower lateral surfaces; mesoscutal patch of dark hairs extending forward and laterally to fuse with posterior pronotal dark hair patch, or almost so 6

Posterior pronotal lobes with few or no dark hairs, *if* with abundant dark hairs, *then* mesepisternal hairs all pale and/or mesoscutal patch of dark hairs not extending forwards and laterally, but separated from posterior pronotal dark hairs by a band of pale hairs on mesoscutum 9

6(5). Tergum 2 with distal pale pubescent band absent or reduced to thin lateral fasciae each less than one third of width of tergum; tergum 3 often with short simple golden-yellow hairs on apical margin in at least lateral fourths; terga 2 and 3 with apical areas shiny, usually with violaceous reflections; wing membranes clear or almost so ..... *Ecplectica* 7

Tergum 2 with distal pale band complete, *if* interrupted medially, *then* each lateral fascia equals one third or more of width of tergum; tergum 3 without fringe of golden-yellow hairs; terga 2 and 3 with apical areas moderately shiny, without violaceous reflections; wing membranes infumate, brownish .. 8

7(6). Tergum 2 with distal pale band absent; tergum 4 with a broad apical, median, triangular patch of dark brown simple hairs with its base on margin of tergum; tergum 3 without golden hairs fringing margin laterally ..... *trifasciata*

Tergum 2 with distal pale band reduced to short lateral fasciae; tergum 4 with a transversely diamond-shaped patch of dark

brown hairs touching apical margin medially; tergum 3 with at least several golden-yellow hairs fringing apical margin laterally ..... *raphaelis*

8(6). Inner hind basitarsi and tibiae with yellow to orange-red hairs; terga 2 and 3 with apical areas minutely and sparsely punctate. *rufodentata*

Inner hind basitarsi and tibiae (usually) with dark reddish-brown to black hairs; terga 2 and 3 with apical areas densely and coarsely punctate ..... *comptoides*

9(5). Scopal hairs brown; inner surfaces of hind basitarsi and tibiae with black to dark brown hairs; apical areas of terga 2 and 3 with coarse punctures separated by one to three puncture widths, ground dulled by dense, coarse tessellation. *negligenda*

Scopal hairs mostly yellow to white; inner surfaces of hind basitarsi and tibiae with variously colored hairs, but usually yellow to dark red; terga 2 and 3 with apical areas usually impunctate or with minute punctures, *if* coarsely punctate, *then* ground areas usually moderately shiny and only delicately shagreened 10

10(9). Mesoscutum with minute punctures separated by two to three puncture widths or more, ground spaces opaque, densely and regularly tessellate ..... *tessellata*

Mesoscutum with large punctures separated by one puncture width or less at least anteriorly and laterally, ground spaces smooth and shiny or somewhat dulled by shagreening, not densely tessellate 11

11(10). Tergum 2 with distal pale band absent or reduced to lateral fasciae equal in length to a third or less of width of tergum, *if* narrowly interrupted medially, *then* terga 2 and 3 with abundant punctures in apical areas and lateral surfaces of thorax with hairs all or almost all black to dark brown 12

Tergum 2 with distal pale band usually complete, unless worn away, *if* narrowly interrupted medially (not due to wear), *then* apical areas of terga 2 and 3 impunctate or with minute punctures and lateral surfaces of thorax with hairs pale in upper halves or more 14

12(11). Inner surfaces of hind basitarsi and tibiae with yellow to orange-red hairs; mesepisternal hairs pale 13

Inner surfaces of hind basitarsi and usually hind tibiae with reddish-brown to black hairs; mesepisternal hairs dark brown to black except pale hairs surrounding wing bases and behind posterior pronotal lobes ..... *maesta*

13(12). Tergum 2 with distal pale band absent; thorax with pale hairs grayish-white; mesepisterna with dark brown hairs ventrally and in upper fourth or more; posterior pronotal lobes usually with at least a few dark hairs ..... *Ecplectica trifasciata*

Tergum 2 with distal pale band reduced to short lateral fasciae; thorax with pale hairs ochraceous to ferruginous; mesepisternal hairs all pale; posterior pronotal lobes without dark hairs. *foxi*

14(11). Tergum 2 with basal pubescent band with many basally plumose and apically spatulate hairs mixed with the normally plumose hairs; clypeus relatively flat, distinctly less than half as long as wide in facial view; mesepisterna without dark hairs. *paroselae*

Tergum 2 with basal pubescent band consisting of normally plumose hairs, *if* with some hairs narrowly spatulate apically, *then* mesepisterna with dark brown hairs ventrally and usually on lower lateral and anterior surfaces; clypeus often relatively bowed outwards and half as long as wide or longer in facial view 15

15(14). Mesepisterna with dark brown hairs at least ventrally, usually anteriorly and often on lower lateral surfaces as well 16

Mesepisternal hairs all pale 22

16(15). Terga 2 and 3 with apical areas with abundant coarse punctures separated mostly by one puncture width or less, *if* sparser, *then* three times basal width of short hairs arising from them or wider; tergum 2 with interband zone as broad as distal pale band or broader and with dark brown hairs at least in median third 17

Terga 2 and 3 with apical areas impunctate, with minute punctures two times basal width of short hairs arising from them or less, *if* with sparse coarse punctures, *then* tergum 2 with interband zone distinctly narrower than distal pale band and often without brown hairs 18

17(16). Tergum 2 with interband zone with punctures separated mostly by less than half a puncture width, with suberect to erect hairs which are stiff and bend tips of pubescence of basal band upwards, with distal pale band usually equal in width to half of apical area medially or almost so (Panamá)..... *panamensis*

Tergum 2 with interband zone with punctures separated by half or more of a puncture width, with appressed or subappressed hairs which do not bend tips of pubescence of basal band upwards, with distal pale band equal to about one third of apical area medially or less 20

18(16). Tergum 2 with interband zone much broader than distal pale band across most of tergum 21

Tergum 2 with interband zone obliterated or no broader than distal pale band across most of tergum 19

19(18). Medium-sized bees; vertex with flattened areas extending medially and somewhat posteriorly from apices of compound eyes with round punctures separated mostly by one puncture width, ground shiny, without or with only sparse delicate shagreening; posterior pronotal lobes without dark hairs ..... *elusa*

Small bees; vertex with lateral flattened areas with coarse, irregular punctures separated mostly by less than one puncture width, ground dulled by dense, irregular, coarse shagreening, *if* sparsely punctate and shiny, *then* posterior pronotal lobes with abundant dark brown hairs 28

20(17). Wing membranes clear or only slightly infumate; tergum 2 with

distal pale band not much arched, about equal in width across tergum, often ochraceous in color, usually equal in width to more than one third of apical area medially; terga 2 and 3 with punctures of apical areas equal to two to three times basal width of hairs arising from them or less ..... *tepaneca*

Wing membranes infumate, yellowish-brown to brown; tergum 2 with distal pale band evenly arched forwards, usually slightly thinner medially, white, usually equal in width to one third of apical area medially or less; terga 2 and 3 with coarse punctures equal to three to four times width of hairs arising from them or more ..... *comptoides*

21(18). Clypeus relatively flat, slightly shorter medially than half of width in facial view; tergum 2 with distal pale band not evenly arched forwards, relatively straight across tergum, usually broader than one third of width of apical area medially, usually ochraceous in color, with interband zone distinctly and evenly punctate across entire width of tergum ..... *tepaneca*

Clypeus strongly bowed outwards from face, slightly longer medially than half of width in facial view; tergum 2 with distal pale band evenly arched forwards, usually one third as wide as apical area medially or less, usually white in color, with interband zone impunctate medially or with punctures small, shallow and obscured by dense shagreening medially. *communis*

22(15). Anterior halves of tegulae and posterior pronotal lobes usually with dark brown to black hairs mixed with the pale, occasionally pronotal lobes without and tegulae with dark hairs, *rarely* with dark hairs absent on both pronotal lobes and tegulae *and then* pale pubescent bands of terga (especially terga 3 and 4) conspicuously yellower than pale thoracic hairs 23

Anterior halves of tegulae and posterior pronotal lobes usually without dark hairs mixed with the pale, occasionally pronotal lobes with and tegulae without dark hairs, *rarely* with dark hairs on tegulae and without dark hairs on posterior pronotal lobes *and then* pale tergal bands concolorous with pale ochraceous thoracic hairs, or tergal bands whiter than thoracic hairs 24

23(22). Terga 2 and 3 with apical areas with small, but distinct, punctures separated mostly by one puncture width or less; tergum 2 with punctures of interband zone round, distinct across entire tergum (Bahama Islands) ..... *cestus*

Terga 2 and 3 with apical areas impunctate or with minute punctures separated mostly by two or more puncture widths; tergum 2 with punctures of interband zone becoming minute medially (United States) ..... *gilensis*

24(22). Pale mesoscutal and scutellar hairs orange-red; tergum 2 with distal pale band relatively straight, not markedly thinned medially, equal in width to half of interband zone; posterior pronotal lobes often with long dark hairs mixed with the pale (West Indies) ..... *rufodentata*

Pale mesoscutal and scutellar hairs ochraceous to white, occasion-

ally somewhat ferruginous anteriorly, *if* orange-red, *then* tergum 2 with distal pale band strongly arched forward, markedly thinned medially and/or narrower than interband zone across most of tergum; posterior pronotal lobes without dark hairs (United States) 25

25(24). Mesoscutum with large posteromedian patch of dark brown hairs; pale mesoscutal and scutellar hairs ochraceous to white, occasionally somewhat ferruginous anteriorly; tergum 2 with distal pale band equal to half or more of apical area medially 26

Mesoscutum with no brown hairs or with small posteromedian patch, *if* this patch extends forward to a transverse line at middle of tegulae or more, *then* pale hairs of thorax orange-red and tergum 2 with distal pale band much narrower than half of apical area medially ..... *thelypodii*

26(25). Terga 2 and 3 with narrow apical area minutely, but distinctly, punctate, ground spaces shiny to moderately so, delicately shagreened ..... *tepida*

Terga 2 and 3 with apical areas impunctate, ground spaces dulled by fine, but very dense shagreening 27

27(26). Tergum 1 with margin piceous or yellowish in apical eighth or less of dorsal surface; head, mesoscutum, scutellum and terga with pale hairs white or grayish-white; tergum 2 with interband zone without distinct punctures ..... *blanda*

Tergum 1 with apical margin translucent or yellowish in apical sixth or more of dorsal surface; head, mesoscutum, scutellum and terga with pale hairs usually ochraceous to pale ochraceous; tergum 2 with small, distinct punctures in lateral fourth or slightly more of interband zone ..... *communis*

28(19). Posterior pronotal lobes with abundant dark brown hairs; facial hairs at least half dark brown; pale hairs of mesoscutum and scutellum orange-red; pale hairs of mesepisterna white at least above (West Indies) ..... *rufodentata*

Posterior pronotal lobes with hairs all pale; facial hairs all pale; mesoscutal hairs ferruginous but not usually orange; mesepisternal hairs pale above but not usually white (United States, Mexico and Central America) ..... *thelypodii*

Melissodes (Melissodes) communis Cresson.

The females of *communis* are recognized by their large size, the lack of punctures in the apical areas of metasomal terga 2 and 3, the rather sparse and large punctures separated usually by more than one puncture width in the posteromedian area of the mesoscutum, the dark brown hairs usually present on the mesoscutum and scutellum and the bright red hairs of the inner surfaces of the hind basitarsi. The males in general have these same characters, but the brown hairs of the mesoscutum are often absent and, in addition, the gonostylus has a tuft of long simple hairs near the base, the median plates of the seventh sternum are in the form of

a long oblique scroll, the apex of the eighth sternum is usually deeply emarginate and bears long simple hairs, and the minimum length of the first flagellar segment equals one sixth of the maximum length of the second segment or more. This species is most easily confused with *M. comptoides* with which it is largely allopatric, but can be distinguished from the latter by the relatively longer first flagellar segment of the male, the impunctate apical areas of the terga in both sexes and by the more sparsely punctate mesoscutum in both sexes, but especially in the female. The western subspecies of *communis* is similar to *M. gilensis* from which it can be distinguished by characters summarized in the diagnosis of the latter.

Female. Measurements and ratios: N, 20; length, 12-16 mm.; width, 4-6 mm.; hooks in hamulus, M = 16.95 ± 0.285; wing length, M = 4.57 ± 0.384 mm.; flagellar segment 1/segment 2, M = 2.01 ± 0.019.

Structure and color: integument generally black; distitarsi usually rufescent; basitarsi and apical areas of metasomal terga 2-4 often reddish-brown; antennal scapes and first two flagellar segments dark brown to black, remaining segments red to reddish-brown below and black above; eyes usually yellowish-green, occasionally gray to yellowish-brown. Clypeus coarsely punctate with punctures mostly round, deep, and separated by half of one puncture width or less, often with raised median carina or boss in apical half which is shiny and impunctate, ground smooth or delicately shagreened, shiny to moderately shiny; supraclypeal area with large round punctures at least laterally, usually dulled by delicate shagreening; flattened areas of vertex extending mesad and somewhat posterior from apices of compound eyes with distinct round punctures separated mostly by one to one half of one puncture width, ground shiny, delicately or not at all shagreened; eyes in facial view three times as long as wide or nearly so, converging slightly below; maxillary palpal segments in ratio of about 6:8:5:1, fourth segment variable and often twice as long; galeae with scattered punctures bearing short straight hairs dorsally, ground smooth and shiny except at tips. Punctures on mesoscutum large, deep, round, crowded anteriorly, laterally and in short posterior declivous area, but larger and separated mostly by more than one puncture width in flattened posteromedian area and often this area almost impunctate, ground shiny, delicately or not at all shagreened; scutellum with punctures of about same size as on adjacent area of mesoscutum except smaller punctures along

midline and periphery, crowded, ground shiny; lateral surfaces of mesepisterna with round, deep punctures of about same size as on anterior half of mesoscutum, separated by less than one puncture width, ground usually delicately shagreened, shiny; metanotum usually as long as or somewhat longer than dorsal face of propodeum medially, with small crowded punctures, ground usually dulled by delicate shagreening, but often smooth and shiny on flat dorsal surface medially; basal face of propodeum reticulopunctate basally, punctures distinctly separated apically, declivous face and lateral faces with crowded large punctures except usually impunctate upper area of declivous face; ground usually dulled by coarse dense shagreening, occasionally shiny on impunctate upper area of declivous face and on basal face. First metasomal tergum with small shallow punctures separated mostly by one half to two puncture widths at least medially in basal half to three fifths, impunctate apically, ground dulled by dense, fine shagreening; tergum 2 with exceedingly small, round punctures beneath basal pubescent band, with small round punctures in interband zone separated mostly by more than one puncture width medially, but somewhat larger and more crowded laterally, without or with exceedingly minute punctures less than two times width of hairs arising from them in apical area, ground dulled by dense, fine shagreening; terga 3 and 4 with small round punctures separated by less than one puncture width medially and often confluent laterally in basal areas, apical area of tergum 3 as in tergum 2, ground dulled by very dense, fine shagreening.

Hair: On head ochraceous to white, often with abundant dark brown hairs on vertex between apices of compound eyes, but these may be sparse or absent. Mesoscutum usually with a large square patch of dark brown to black hairs in posteromedian area, reduced to a few hairs or absent in a few individuals, pale hairs of mesoscutum usually ochraceous, but often white in specimens from the eastern part of the range and pale rufescent in the west; scutellum with large median patch of dark hairs fringed with ochraceous to white hairs. First metasomal tergum with long pale hairs in basal two thirds or less and laterally to margin, apical area mostly bare, but with a few simple, appressed, dark brown hairs at extreme sides; tergum 2 with basal band of pale pubescence composed at least partially of basally plumose and apically narrowly spatulate hairs, joined at extreme sides with thin distal band of pale pubescence which equals about one third of apical area or more medially,

interband zone and apical area with erect, suberect or appressed dark brown to black hairs; tergum 3 with broad median band of pale pubescence which is thick apically, thinner and more diffuse basally, basal area of tergum with abundant dark brown to black, erect or suberect hairs and pubescence, apical area as in tergum 2; tergum 4 with broad apical band of pale pubescence, often interrupted medially by a small triangle or rectangle of dark brown suberect hairs, basal areas as in tergum 3; terga 5 and 6 covered with dark brown to black appressed hairs, often with tufts of long pale hairs at extreme sides, especially on tergum 5. Inner surfaces of hind basitarsi and hind tibiae with bright red to yellow hairs; scopal hairs white to ochraceous.

Male. Measurements and ratios: N, 20; length, 10-15 mm.; width, 3.5-5.5 mm.; wing length, $M = 4.18 \pm 0.371$ mm.; hooks in hamulus, $M = 15.05 \pm 0.328$; flagellar segment 2/segment 1, $M = 4.80 \pm 0.115$.

Structure and color: Clypeus, bases of mandibles and entire labrum pale to bright yellow, yellow spot at base of mandible usually covers entire basal half or at least wider than depressed basal triangular area; scape dark reddish-brown to black, flagellum red to yellow above, dark brown to black below; eyes gray-brown to yellowish-green; integument otherwise generally black except legs often wholly red, at least distitarsi red, and apical areas of metasomal terga often hyaline or translucent. Minimum length of first flagellar segment usually equal to one sixth of maximum length of second segment, occasionally slightly less and often more, always distinctly longer than pedicle; maxillary palpal segments as in female, but rarely with a minute fifth segment; head sculptured as in female, but clypeus less coarsely punctate. Sculpturing of thorax as in female, but posteromedian area of mesoscutum sometimes with more crowded punctures. Sculpturing of metasoma as in female, but basal punctate area of tergum 1 equal to three fifths or more of median length of tergum, ground exceedingly densely shagreened and punctures small and shallow.

Gonostylus short, capitate, with basal outer tuft of long, simple hairs directed distally; inner surface of gonocoxite below gonostylus with abundant short simple hairs and with several short blunt hairs intermixed with pointed hairs, ventral surfaces of gonocoxite below gonostylus with several very short, simple, pointed hairs; spatha not emarginate medially, with a small notch on distal margin laterally to receive dorsal lamella of penis valve, lateral

processes rectangular and directed anterolaterally. Sternum 7 with lateral plate less than twice as long as wide and usually shorter than half length of tergum from tip of plate to tip of apodeme; median carinae form a broadly V-shaped structure, not reaching apex of sternum medially; median plate large, forming and elongate, oblique, half to three quarter cylinder more than twice as long as wide; apodeme long, thin, pointed or rounded apically. Sternum 8 emarginate apically, with long simple hairs at apex laterally, with a high, longitudinal, ventral, median carina which just exceeds apex of sternum medially; lateral apodemes short, with slightly narrower neck region and a minute basally projecting process (Figs. 69-72).

Hair: Color and pattern much as in female, but with the following differences: rarely with dark hairs on head; often mesoscutum without dark hairs and scutellum occasionally without dark hairs; lower lateral, ventral and anterior surfaces of mesepisterna never with dark brown hairs; first metasomal tergum rarely bare apically, usually with dark brown appressed hairs across entire apical area and often these hairs yellowish at least medially; tergum 2 with distal pale band wider, usually equal to more than one third of apical area medially, hairs of apical and interband zone often pale, but usually dark brown to black; tergum 4 with a complete pale pubescent band separated from margin across most of tergum by an apical area similar to that on terga 2 and 3; tergum 5 often with a complete pale apical band; terga 6 and 7 with dark brown to black hairs, but usually with large pale tufts of hairs laterally.

Geographical variation. Two subspecies of *communis* are recognized here, the darker race, *communis s. str.*, occupying eastern United States and northern Mexico, and the paler race, *alopex*, occupying western United States and southwestern Canada. *M. communis* throughout its range is highly variable in regard to size. The largest specimens are those from Utah. The eastern race is more variable than the western in regard to color of vestiture and integument.

The specimens of *communis s. str.* from along the Atlantic Coast south into Florida and west through the Gulf States to Louisiana are on the average smaller in size and slightly darker in color than specimens from the plains area. The patch of brown hairs on the mesoscutum is always present in females from this eastern area, almost always present in the males, and is on the average larger than in specimens from farther west. The pale hairs of the body, how-

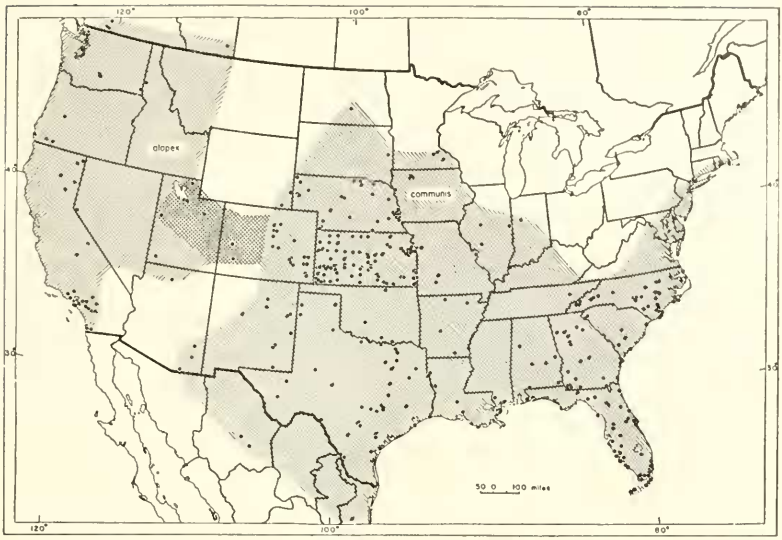

Fig. 11. Map showing the distribution of *M.* (*Melissodes*) *communis*. The overlapping type of shading indicates the zone of intergradation between the two subspecies.

ever, are white or extremely pale ochraceous in these eastern specimens, whereas farther west the pale hairs at least of the thorax and head are usually ochraceous and often become pale rufescent on the anterior part of the mesoscutum. This difference is less well expressed in the males than in the females. The eastern males only rarely have subhyaline apical margins on the metasomal terga and almost always have a large patch of reddish-brown hairs on the mesoscutum as well as the scutellum, unlike the western males. In spite of these differences indicating a third subspecies, no characters were found which would separate these specimens in a reasonable number of cases. A relatively smooth cline probably exists across the eastern United States in color characters and in size, but the paucity of material from the central states of Ohio, Indiana, Pennsylvania, Kentucky, Tennessee, Alabama, Mississippi, Louisiana and Arkansas prevents an adequate description of the changes occurring in this area.

A single female from Ness Co., Kansas, has the hairs of the head and thorax almost completely dark brown. A very few pale hairs remain near the antennal fossae and in a thin line between the mesoscutum and the scutellum. The abdominal banding is typical and this specimen is considered to be nothing more than

a melanistic variant of *M. communis communis*. It is of interest because it parallels closely certain melanistic variants of *M. comptoides* which appear in the southern and eastern parts of the range of the latter. *M. rufodentata* of the West Indies also presents certain melanistic individuals similar to those of *communis* and *comptoides*.

Three females and two males from Mexico have much redder hairs on the thorax than normal. This is not unique within this species, but is mentioned because of the great similarity of these red individuals to another Mexican species (*M. elusa*). The sparsely punctate posteromedian area of the mesoscutum and the complete distal pale band of tergum 2 clearly identify these specimens as *communis*.

M. communis alopex is a rather distinct subspecies which does not display a great amount of variability, as does *communis s. str.*, except in size. A series of five females from Salt Lake City, Utah, shows a tendency towards the darker color of *communis* of the east. One of these has a small patch of dark brown hairs on the ventral surface of each mesepisternum and another has a small patch of dark hairs medially on the fourth tergum. All five have the distal pale band of tergum 2 broader than usual in *communis s. str.*, and narrower than usual in *alopex*. A single male from Saltair, west of Salt Lake City, Utah, is intermediate in that it has dark sternal hairs and one male from Troutcreek, southwest of Salt Lake City, is also intermediate in that the pale distal band of tergum 2 is narrow and the apices of the terga are slightly infumate. A single male from Logan, Utah, is quite intermediate. It bears all of the characteristics of *alopex* except that the distal band of tergum 2 is narrow and the pale band of tergum 5 is absent. A single female from Logan resembles the females from Salt Lake City. One male from the north rim of the Grand Canyon, Arizona, is typical of *alopex* and is the only specimen of this subspecies from Arizona. South of the Grand Canyon, three females from southeastern Arizona are typical specimens of *communis*.

The holotype of *alopex*, unfortunately, is from a locality (Duchesne, Utah) east of the above named Utah localities. It is probably from the zone of intergradation, but is typical of *alopex*, not differing from the Californian specimens. Such specimens would be expected to occur in the zone of intergradation, if one considers the situation in such zones within other species of *Melissodes*. Two males from Delta in western Colorado are intermediate in character, but are no paler than the palest of the Great Plains

specimens. These males should not be considered as decisive, since, as in most *Melissodes,* the males are more variable than the females and the subspecies are based primarily on female characters. Another male from San Miguel, Colorado, is similar to those from Delta. Lack of material prevents adequate description of the zone of intergradation and, until additional material becomes available, the zone can be considered to occupy the largely hypothetical area outlined on the map (Fig. 11).

Melissodes (Melissodes) communis communis Cresson

Melissodes communis Cresson, 1878, Proc. Acad. Nat. Sci. Philadelphia, vol. 30, p. 204; Cockerell, 1898, Bull. Univ. New Mexico, vol. 1, p. 66; 1898, Bull. Sci. Labs. Denison Univ., vol. 11, p. 66; 1906, Trans. Amer. Ent. Soc., vol. 32, p. 92; Snow, 1906, Trans. Kansas Acad. Sci., vol. 20, p. 137; Smith, 1910, Ann. Rept. New Jersey State Museum, 1909, p. 693; Cockerell, 1914, Proc. Ent. Soc. Washington, vol. 16, p. 31.

Melissodes hortivagans Cockerell, 1905, Proc. Biol. Soc. Washington, vol. 18, p. 180 (new synonymy); 1906, Trans. Amer. Ent. Soc., vol. 32, pp. 78, 83, 107; 1906, Ann. Mag. Nat. Hist., ser. 7, vol. 17, p. 360; 1936, Amer. Mus. Nov., no. 831, p. 5.

Melissodes martini Cockerell, 1905, Ann. Mag. Nat. Hist., ser. 7, vol. 15, p. 526 (new synonymy); 1906, Trans. Amer. Ent. Soc., vol. 32, pp. 86, 93; 1906, Trans. Amer. Ent. Soc., vol. 32, p. 309; 1928, Univ. Colorado Studies, vol. 16, p. 114.

Melissodes variabilis Robertson, 1905, Trans. Amer. Ent. Soc., vol. 31, p. 368 (new synonymy); 1928, Flowers and Insects, p. 8.

Melissodes xanthopteralis Cockerell, 1906, Ann. Mag. Nat. Hist., ser. 7, vol. 17, p. 362 (new synonymy).

Melissodes manni Cockerell, 1924, Amer. Mus. Nov., no. 113, p. 1 (new synonymy).

Melissodes hortivagans melanotica Cockerell, 1925, Ann. Mag. Nat. Hist., ser. 9, vol. 16, p. 231 (new synonymy); 1928, Univ. Colorado Studies, vol. 16, p. 114.

This subspecies is distinguished from *alopex* by having a narrower distal band on tergum 2 and the pubescence of the metasoma being white at least in the female. In addition, the females have dark hairs on at least the ventral surfaces of the mesepisterna and the males usually have the apical areas of terga 1-5 dark, opaque to subhyaline, and the pale band of tergum 5 interrupted or absent.

Female. Structure and color: First tergum usually completely black or with an extremely narrow hyaline margin, occasionally more broadly hyaline apically; wing membranes infumate, yellow to dark brown, darkest in specimens from southeastern United States, veins dark red to black. Supraclypeal area with ground often dulled by fine shagreening; occasionally smooth and shiny; declivous face of propodeum usually with large upper impunctate triangle, occasionally reduced to small oval area; first tergum with small punctures in basal area usually separated by one or more puncture widths medially.

Hair: On labrum, mandibles and apical half of clypeus often brown; mesoscutellar patch of brown hairs occasionally reduced to several hairs or absent; pale hairs of dorsum of thorax often pale rufescent, usually ochraceous and occasionally white; ventral surfaces of mesepisterna, and usually anterior and lower lateral surfaces as well, with dark brown to black hairs; pubescent bands of metasoma usually white; tergum 2 with distal band usually equal to one third or less of apical area medially, occasionally slightly broader, but never as wide as half of apical area; tergum 4 usually with at least a small apical patch of dark brown hairs medially; terga 5 and 6 often without lateral tufts of long white or ochraceous hairs; sternal hairs dark brown to black, usually with small tufts of pale hairs laterally. Legs with variable hairs, generally white or pale ochraceous except as follows: fore tarsi dark reddish-brown, inner surfaces of fore and middle tibiae often brown at least apically, femora often dark brown, especially below and on posterior surfaces, scopal hairs usually ochraceous but sometimes paler, basitibial plates dark brown, inner surfaces of hind tibiae and basitarsi with red to yellow hairs.

Male. Structure and color: Apical areas of metasomal terga usually opaque, reddish-brown to black, occasionally hyaline but rarely completely colorless. Supraclypeal area with ground often dulled by fine shagreening; minimum length of first flagellar segment usually equal to about one sixth of maximum length of second segment, occasionally slightly shorter and rarely longer.

Hair: Pale hairs of head and thorax usually ochraceous, occasionally pale rufescent on anterior half of mesoscutum; pale pubescence of metasoma usually white, but often pale ochraceous; distal pale band of tergum 2 usually equal to about one half of apical area medially, often much less but rarely more; tergum 5 often with pale apical band interrupted medially or absent; tergum 5 usually and tergum 6 occasionally with a few long pale hairs laterally; sternal hairs usually mostly dark brown to black, often all red to ochraceous laterally and on basal few sterna, but usually brown medially on at least distal sterna. Legs with white to ochraceous hairs except rufescent hairs on distitarsi, inner surfaces of basitarsi and hind tibiae.

Bionomics. A group of twenty-two males of *M. communis communis* were collected by C. V. Riley at Centerville, Florida, on August 29 (year not given). These bees were apparently resting or sleeping clustered on a small twig. The bees and twig were

collected together and the bees were loosely tied to the twig with black thread. This interesting display is in the collection of the U. S. National Museum.

This subspecies is highly polylectic. It seemingly collects little pollen from Compositae, although the species has been collected visiting a number of plants of this family. It appears to prefer Leguminosae and Labiatae and visits a large number of other non-Compositae. This bee is partial to *Melilotus* and *Medicago*, judging from the collection data, and could be of importance in pollination of the latter. Below are tabulated figures giving a general picture of the flower preferences of *communis* (Table IV). Note the difference in proportions of males to females collected on Compositae in contrast to the non-Compositae. This probably indicates that composites were visited primarily for nectar and not for pollen. Significant also is the fact that a relatively larger number of bees were collected per species of non-Compositae than per species of Compositae.

Table IV.—Summary of floral records for *Melissodes communis communis*.

Plant data				Records of *M. communis communis*			
Family	Number of Famlies	Number of Genera	Number of Species	Number of Collections	Number of Females	Number of Males	Total Number of Bees
Compositae	1	12	15	27	10	22	32
Labiatae	1	6	11	21	24	24	48
Leguminosae	1	8	11	42	56	48	104
Others	16	21	25	51	59	31	90
Totals	19	47	62	141	149	125	274

Type material. Lectotype female and lectoallotype male of *communis* from Georgia is in the Academy of Natural Sciences of Philadelphia. Holotype male of *hortivagans* from Garden City, Kansas, August, 1895, H. W. Mencke, is in the Snow Entomological Museum at the University of Kansas. Holotype male of *manni* from Garden Canyon, Huachuca Mts., Arizona, W. H. Mann, is

in the American Museum of Natural History, New York City. Holotype female of *martini* from Gallinas River (La Cueva), New Mexico, August 6, Parks and Cockerell, is the property of the California Academy of Sciences, but on temporary deposit in the collection of the Citrus Experiment Station, Riverside. Holotype female of *melanotica* from La Junta, Colorado, August 12, 1920, is in the American Museum of Natural History, New York City. Lectotype female of *variabilis,* here designated, from Carlinville, Illinois, August 7, 1895, on *Monarda fistulosa,* Charles A. Robertson (collection no. 17545) and lectoallotype male of *variabilis,* here designated, from Carlinville, Illinois, July 6, 1897, on *Pycnanthemum linifolium,* Charles A. Robertson (collection no. 19780), are in the collection of the Illinois Natural History Survey, Urbana. Holotype male of *xanthopteralis* from Fedor, Texas, July 26, 1901, G. Birkmann, is the property of the California Academy of Sciences, but on temporary deposit in the collection of the Citrus Experiment Station, Riverside.

Distribution. Southeastern Arizona south to Chihuahua, Mexico, and north through eastern Colorado and Wyoming to North Dakota and eastward through Illinois and Indiana in the north and through Texas and the Gulf States in the south to the Atlantic (Fig. 11). These bees have been collected from March 16 to September 23 in various parts of the range as follows: Florida, March 16 to September 17; Texas, April 18 to September 23; Nebraska, June 22 to September 14. However, they are most abundant from the end of June through August in most areas. In addition to the type material, 595 females and 555 males have been examined. The localities of these, plus localities reported in the literature, are listed below.

ALABAMA: Auburn; Burkville; Cowarts; Flomaton; Moore's Bridge; Selma; Seminole. ARKANSAS: Lawrence Co.; Marion Co.; Hot Springs. ARIZONA: Garden Canyon, Huachuca Mts.; Thatcher; Wilcox, Cochise Co. COLORADO: Baca Co.; Boulder; Chivington; Colorado Springs; Crowley; Denver; Duck Creek; Eads; Fort Lupton; Golden; La Junta; Lamar; Limon; Midland; Mill Gulch; Prowers; Rocky Ford; Two Buttes; Walker Hill, Crowley Co. DELAWARE: Dover. FLORIDA: Alachua Co.; Bartow; Biscayne Bay; Boca Grande; Cedar Key; Centerville; Cocoa; Cocoanut Grove; Coral Gables; Crescent City; Dade City; Daytona; Englewood; Fort Lauderdale; Fort Myers; Gainesville; Goulds; Homestead; Indian River; Jacksonville; Key Largo; Key West; Lacoochee;

Larkins; Long Key; Marco; Miami; Miami Beach; Monroe Co.; Naples; Naranja; No Name Key; Paradise Key; Parish; Perry; Punta Gorda; Royal Palm Hammock; Royal Palm State Park; Sanford; Sannibel Island; South Bay, Lake Okeechobee; South Miami; Suwanee Springs; Tamiami Trail; Titusville; Torreya Ravine; Upper Metacumba Key; Winter Park. Georgia: Athens; Atlanta; Bainbridge; Billy's Island, Okefenokee Swamp; Brinson; Butler's Ferry, Decatur Co.; Chester; Deenwood; DeWitt; Griffin; Kenesaw Mt.; Pomona; Rockmart; Shellman; Spring Creek, Decatur Co.; St. Simons; Thomasville; Thomsons Mills; Tybee; Unadilla. Illinois: Bishop; Carlinville; Oakwood. Indiana: Lafayette; South McAllester. Iowa: Sioux City. Kansas: Arma, Crawford Co.; Baldwin, Douglas Co.; Barber Co.; Bourbon Co.; Charleston, Gray Co.; Chautauqua Co.; Cherokee Co.; Cowley Co.; Crawford Co.; Decatur Co.; DeSoto, Johnson Co.; Dickinson Co.; Douglas Co.; Ellis Co.; Ellsworth Co.; Eudora, Douglas Co.; Finney Co.; Fort Scott, Bourbon Co.; Garden City, Finney Co.; Grant Co.; Gray Co.; Gove Co.; Hamilton Co.; Hays, Ellis Co.; Hodgeman Co.; Holcomb, Finney Co.; Hudson, Stafford Co.; Hugoton, Stevens Co.; Hutchinson, Reno Co.; Jetmore, Hodgeman Co.; Jewell Co.; Johnson Co.; Kearny Co.; Kiowa Co.; Lakin, Kearny Co.; Lawrence, Douglas Co.; Leavenworth Co.; Liberal, Seward Co.; Logan Co.; McPherson Co.; Manhattan, Riley Co.; Marshall Co.; Meade, Meade Co.; Medora, Reno Co.; Morton Co.; Neodesha, Wilson Co.; Ness Co.; Pawnee Co.; Phillips Co.; Pratt Co.; Rawlins Co.; Reno, Leavenworth Co.; Reno Co.; Rice Co.; Richfield, Morton Co.; Riley Co.; Russell Co.; Saline Co.; Scott City, Scott Co.; Sedgwick Co.; Seward Co.; Sharon Springs, Wallace Co.; Shawnee Co.; Sheridan Co.; Sherman Co.; Smith Co.; Stafford Co.; Stanton Co.; Stevens Co.; Sumner Co.; Sunflower, Douglas Co.; Syracuse, Hamilton Co.; Thomas Co.; Topeka, Shawnee Co.; Trego Co.; Wallace Co.; Wilson Co.; Winfield, Cowley Co.; Wichita, Sedgwick Co. Louisiana: Keatchie; Logansport; Negreet; Olivier; Opelousas. Massachusetts: Woods Hole. Minnesota: Faribault; Rochester; Stanton. Mississippi: Biloxi; Gulfport; McNeill. Missouri: Atherton; Buffalo; Springfield; St. Louis. Nebraska: Alliance; Ashland; Badger; Carns; Dundy Co.; Dunning; Fairmont; Glenn, Sioux Co.; Haigler; Halsey; Hardy; Holt Co.; Imperial; Lexington; Lincoln; Louisville; Meadow; Mitchell; Nebraska City; Neligh; Niobrara; Omaha; Scottsbluff; South Bend; Sutherland; Union; War Bonnet Canyon; Weeping Water; West Point. New Mexico: Acme; Alberg; Eddy Co.;

Galinas River (La Cueva); Isleta; Las Vegas; Portales; Roswell (5 miles S.); Tucumcari. NORTH CAROLINA: Beaufort; Black Mts. (valley of); Burgaw; Cape Fear River (mouth of); Carolina Beach; Faison; Fort Fisher; Fort Macon; Goldsboro; Governors Island; Barkers Island; Holly Shelter; Judson; Kingsboro; La Grange; Lakeview; Long Beach; Lumberton; Marion; Montague; Point Harbor; Raleigh; Rocky Mt.; Smoky Mt.; Spout Springs; Southern Pines; Statesville; Swannanoa; Tarheel; West End; Willard; Wilmington; Wrightsville. NORTH DAKOTA: Steele. OKLAHOMA: Anadarko; Ardmore; Durant; Washunga. SOUTH CAROLINA: Clemson College; Edesto Beach; Hampton Park; Myrtle Beach; St. George; St. Mathews. SOUTH DAKOTA: Brookings. TENNESSEE: Knoxville. TEXAS: Adrian (10 miles W.), Oldham Co.; Austin; Barstow; Bastrop; Bexar Co.; Cypress Mills, Blanco Co.; Dallas; Davis Mts.; Devil's River (near Del Rio); Dilley; Fedor, Lee Co.; Galveston; Giddings; Goliad; Jacksonville; Laredo; Lee Co.; Longview (6 miles E.); Mexia; Nueces; Quinlan; Red River, 2 miles W of Estelline; Rockport (10 miles N.); Romero; Rosser; San Angelo, Tom Green Co.; Weser; Wichita Falls; Willis; Wolfe City. WYOMING: Cheyenne; Torrington. CHIHUAHUA: Chihuahua (10 miles S. E.); Delicias. TAMAULIPAS: Padilla.

Flower records. M. communis communis has been collected visiting the flowers listed below. Records from Robertson's (1928) list are included here, but do not figure in the tabulation (Table IV) above, since quantitative data was not available.

Abutilon theophrasti, Althaea rosea, Amorpha sp., *Asclepias syriaca, A. tuberosa, Baptisia* sp., *Befaria racemosa, Blephilia hirsuta, Brazoria truncata, Campanula* sp., *Cassia fasciculata, Chrysopsis angustifolia, Cirsium* sp., *C. discolor, C. lanceolatum, Cleome serrulata, Convolvulus* sp., *Croton* sp., *Cucurbita* sp., *Cyrilla parviflora, Dalea* sp., *D. multiflora, Dianthera americana, Echium vulgare, Gossypium herbaceum, Grindelia* sp., *Helenium tenuifolium, Helianthus* sp., *H. annuus, H. lenticularis, Heliotropum* sp., *Hyrtia* sp., *Ipomoea* sp., *Lactuca* sp., *Lythrum alatum, L. lineare, Malva sylvestris, Medicago sativa, Melilotus* sp., *M. alba, Mentha* sp., *Monarda* sp., *M. citriodora, M. fistulosa, M. pectinata, M. punctata, Nepeta cataria, Oenothera elliptica, O. laciniata, Opuntia* sp., *Passiflora* sp., *P. incarnata, Petalostemum* sp., *P. occidentale, P. purpureum, P. violaceum, Phaseolus* sp., *Platycodon grandiflorium, Prionopsis* sp., *Proboscidea louisianica, Pycnanthemum* sp., *P. flexuosum, Ratibida columnifera, Rudbeckia* sp., *Rhus* sp., *R. glabra, Salvia* sp., *Sidalcea*

reticulata, Solanum elaeagnifolium, Solidago sp., *S. serotina, Teucrium* sp., *T. canadense, Thelesperma megapotamicum, Verbena* sp., *V. stricta, Vernonia* sp., *V. baldwini interior, V. glauca.*

Melissodes (Melissodes) communis alopex Cockerell.

Melissodes alopex Cockerell, 1928, Psyche, vol. 35, p. 333.

This subspecies can be recognized by the characters listed in the diagnosis of *communis s. str.* and described below.

Female. Structure and color: First tergum always with apical margin at least translucent reddish-brown, usually hyaline, colorless or yellow; wing membranes usually somewhat infumate, yellowish, veins dark reddish-brown. Supraclypeal area with ground shiny and smooth; declivous face of propodeum usually with impunctate upper area reduced to a small oval, occasionally almost completely punctate; first tergum with small punctures of basal area separated mostly by less than one puncture width.

Hair: Labrum, mandibles and clypeus with yellowish or ochraceous hairs, never brown; mesoscutellar patch of dark hairs always present, large, usually with a medially indented anterior margin so as to appear cordate in outline; pale hairs of head and dorsum of thorax ochraceous, never rufescent and never white; pale pubescence of metasoma ochraceous, scarcely, if at all, paler than pale thoracic hairs; sides of thorax with ochraceous hairs, occasionally somewhat paler than pale hairs of dorsum; mesepisterna without dark hairs ventrally, anteriorly or laterally; distal pale band of tergum 2 always wider than one third of apical area medially (unless worn) and usually as wide as one half of apical area or wider; pale band of terga 3 and 4 broader than in *communis s. str.;* tergum 4 with small median apical patch of ochraceous suberect hairs, never brown, often rubbed off; terga 5 and 6 always with lateral tufts of ochraceous hairs; sternal hairs usually dark reddish-brown to red, except dark brown on last sternum, yellow apically and ochraceous laterally on each sternum. Legs with ochraceous hairs except as follows: fore basitarsi and apices of outer surfaces of fore and middle tibiae often brown; inner surfaces of tarsi and tibiae red to yellow; basitibial plates brown.

Male. Structure and color: Apical areas of terga always broadly hyaline, yellow to colorless. Supraclypeal area as in female; minimum length of first flagellar segment usually equal to one fifth of maximum length of second segment, occasionally less and often more.

Hair: Pale hairs of head and thorax ochraceous, rarely white; distal pale band of tergum 2 usually equal to more than one half of apical area in width medially, never less (unless worn), often as wide as apical area; tergum 5 always with a complete apical band of ochraceous pubescence; terga 6 and 7 with lateral tufts of long pale hairs; sternal hairs red to yellow medially, white laterally, occasionally apical sternum with reddish-brown hairs. Legs with pale ochraceous hairs except reddish-orange to yellow on inner surfaces of tarsi.

Remarks. In the original description of the male holotype, Cockerell makes the following statements: ". . . pubescence in general much redder, fox-red on thorax and very bright on tibiae and tarsi . . .", ". . . wings strongly blackish . . ." and ". . . hind margins of abdominal segments not at all hyaline . . ." These all are errors. The holotype has rather dark ochraceous hairs on the thorax and yellowish-ochraceous hairs on the tibiae and tarsi. The wings of the holotype are not strongly blackish, although they are somewhat infumate, but are best described as yellowish-brown. The hind margins of the terga are broadly hyaline. Cockerell was led astray in regard to the hyaline nature of the terga because the abdomen of the holotype is stretched out and each tergum is closely applied to the surface of the preceding tergum. Also, each tergum was wetted or greased beneath at one time. This allows the dark color of the preceding tergum to show through the very hyaline apices of the terga, making them appear opaque.

Type material. The holotype male from Duchesne, Utah, July 1926, Vasco M. Tanner, is the property of the California Academy of Sciences, but temporarily deposited in the collection of the Citrus Experiment Station, Riverside.

Distribution. From southernmost California north to British Columbia and east to Alberta and Utah (Fig. 11). These bees have been collected from May 15 to September 12, but mainly during June and July. In addition to the holotype, 99 females and 72 males were examined from the localities listed below.

ARIZONA: Grand Canyon (north rim). CALIFORNIA: Altadena; Alturas, Modoc Co.; Bishop, Inyo Co.; Chula Vista; Corona; Dulzura; Etiwanda; Fillmore; Glendale; Glendora; Hemet (8 miles W.); Idyllwild; Kaweah; La Jolla; Lake City, Modoc Co.; Lassen Park, Shasta Co.; Litchfield, Lassen Co.; Long Beach; Los Angeles; Los

Angeles Co.; Pasadena; Quincy (4 miles W.); Riverside; Santa Monica Mts.; South Fork Camp, San Bernardino Mts.; Tanbark Flat, Los Angeles Co.; Upper Santa Ana River, San Bernardino Co.; Whittier; Whittier Lake. Colorado: * Delta; * San Miguel. Idaho: Moscow. Nevada: Minden. Oregon: Gold Beach; Murphy, Josephine Co.; Oakridge, Lane Co.; Phoenix. Utah: * Duchesne; * Logan; Pine Valley Mts.; * Saltair; * Salt Lake City; * Troutcreek, Joab Co. Washington: Asotin, Snake River; North Yakima; Yakima. Alberta: Medicine Hat. British Columbia: Penticton; Summerland; Westbank.

Flower records. As in *communis s. str.*, the subspecies *alopex* has been taken more often on non-Compositae than on Compositae. This subspecies has been collected on the flowers listed below.

Brassica sp., *Cirsium* sp., *Clarkia elegans, Datura meteloides, Duranta plumieri, Eriodictyon trichocalyx, Gilia capitata, Godetia amoena, Hugelia virgata, Lotus* sp., *L. scoparius, Malvastrum fasciculatum, Medicago sativa, Melilotus* sp., *Monardella lanceolata, Opuntia littoralis, Phacelia ramisissima, Salvia apiana, S. carnosa, Scabiosa* sp., *Sphaeralcea* sp., *S. fasciculata, Stachys ajugoides, Stephanomeria exigua, Trifolium involucrata.*

Melissodes (Melissodes) elusa, sp. nov.

Melissodes elusa is very difficult to separate from the foregoing species. The first flagellar segment of the male, so useful in other species of this subgenus, is here highly variable and ranges in length from one seventh or less to about one fifth of the second segment. Both sexes of *elusa* are like *thelypodii* and *communis* in lacking coarse punctures in the apical areas of the metasomal terga. The metasomal punctation is otherwise more like that of *thelypodii* than like *communis.* The brown hairs on the ventral, lower anterior and lower lateral surfaces of the mesepisterna serve to distinguish females of *elusa* from those of *thelypodii s. str.*, and the larger size of *elusa* will serve to separate the females from those of *M. thelypodii stulta.* The presence of a complete pale band on the fifth tergum in the male will separate these from the males of *stulta.*

Female. Measurements and ratios: N, 4; length, about 14 mm.; width, about 5 mm.; wing length, $M = 4.73 \pm 0.475$ mm.; hooks in hamulus, $M = 15.50 \pm 0.647$; flagellar segment 1/segment 2, $M = 1.99 \pm 0.032$.

* Localities considered as in the zone of intergradation.

Structure and color: Integumental color as in *communis,* but flagella dark, with only a narrow dark reddish-brown zone ventrally; wings deeply infumate. With structural and sculptural characters of *communis* with the following differences: clypeus usually more coarsely punctate; mesoscutum as in the more coarsely punctate specimens of *communis,* punctures well separated but without a virtually impunctate posteromedian area; basal area of first tergum with distinct round punctures separated mostly by less than one half of one puncture width, ground shagreened but moderately shiny; interband zone of tergum 2 narrow, with coarser, deeper punctures separated mostly by less than half of one puncture width, especially in lateral raised areas; terga 1-3 with moderately shiny apical areas, although finely shagreened, not dulled as in *communis.*

Hair: With hair and pubescence as in *thelypodii s. str.* with the following differences: scutellum with a few to many dark brown hairs medially; mesoscutum with few to many dark brown hairs in posteromedian area; mesepisterna with dark brown hairs on ventral, lower anterior and often lower lateral surfaces; pubescent bands of metasoma white; tergum 3 with pale band narrower medially than apical apubescent area; inner surfaces of hind basitarsi with orange-red to dark reddish-brown hairs.

Male. Measurements and ratios: N, 20; length, 11-15 mm.; width, 3-5 mm.; wing length, $M = 4.53 \pm 0.428$ mm.; hooks in hamulus, $M = 14.40 \pm 0.303$; flagellar segment 2/segment 1, $M = 5.49 \pm 0.103$.

Structure and color: Integumental color as in *communis* with the following differences: mandibles with basal yellow spots usually restricted to the depressed triangular areas or slightly larger; labrum occasionally with a narrow brown margin laterally; apical areas of terga always black and opaque; legs except tarsi always black. Structural and sculptural characters as in *communis* with the following differences: first flagellar segment of variable length, minimum length equals one eighth to one fifth of maximum length of second segment; mesoscutum without a relatively impunctate posteromedian area, punctures as in more densely punctate specimens of *communis;* punctures in basal area of tergum 1 and in interband zone of tergum 2 as in female. Genitalia and hidden sterna as in *communis.*

Hair: With hair and pubescence characters of *thelypodii* with the following differences: scutellum usually and mesoscutum often

with a few dark reddish-brown hairs medially; apical area of tergum 1 and interband zone of tergum 2 often with dark brown hairs; tergum 2 with distal pale band usually extremely narrowly interrupted medially; tergum 4 with pale band distinctly notched along posterior margin, almost interrupted medially by the notch; tergum 5 always with a complete pale band; pale metasomal bands always white.

Remarks. It is possible that *elusa* is a southern subspecies of *communis*. The evidence for such an hypothesis is weak. *M. communis* has been collected in Mexico only three times and these specimens (three females and two males) are typical specimens of *communis* except for the slightly more rufescent thoracic hairs. They do not show evidence of intergrading with *elusa* in structural characters, such as the punctation and shagreening of the terga. *M. elusa* could be considered as a southern subspecies of *thelypodii*, if *stulta* were not known. The males of *elusa* and *thelypodii s. str.* are remarkably similar and some specimens are indistinguishable (especially old and worn individuals). It is best, therefore, to consider *elusa* as a distinct species until additional material becomes available, especially from northern Mexican states of Chihuahua and Coahuila.

Type material. Holotype male and allotype female and three paratype males collected by H. E. Evans at Guadalajara, Jalisco, July 23, 1951. Paratypes are as follows: Fresnillo, Zacatecas, 14 males, August 15, 1947, C. D. Michener; Sain Alto, Zacatecas, 3 males, August 14, 1947, on *Gutierrezia* sp., M. A. Cazier; Villa Guadalupe, Jalisco, 1 female, July 25, 1951, on *Asclepias* sp., P. D. Hurd; Guadalajara, 2 males, July 24, 1951, P. D. Hurd; Guadalajara (vicinity), Jalisco, 1 male, 1901, M. Diguet; Encarnación, Jalisco, 1 male, July 28, 1951, P. D. Hurd; Tizapán, Jalisco, 1 female, July 18, 1953, Univ. of Kansas Mexican Expedition; Puebla (6 miles S. W.), Puebla, 3 males and 1 female, July 2, 1953, 6600 feet altitude, Univ. of Kansas Mexican Expedition. The holotype and allotype are in the Snow Entomological Museum at the University of Kansas. Paratypes are in the collections of the Snow Entomological Museum, the U. S. National Museum, the American Museum of Natural History, the University of California, Berkeley, and in the author's collection.

Distribution. From southeastern Arizona south to Oaxaca, Mexico, and west to Michoacán, Mexico. In addition to the type material, this species has been collected from the localities listed below.

ARIZONA: Carr Canyon, Huachuca Mts. (a single worn male probably belongs here). CHIHUAHUA: Catarinas; Santa Barbara. DURANGO: Durango; Nombre de Dios. MICHOACAN: Quiroga. OAXACA: Oaxaca. PUEBLA: Puebla.

Melissodes (*Melissodes*) *flexa,* sp. nov.

M. flexa is a Mexican species having long flexible hairs on the head and thorax of the male. The first flagellar segment is long, the minimum length equaling one third to one fourth of the maximum length of the second segment. The labrum of the male has a distinct brown apical margin. The hairs on the lower half of the lateral surfaces of the mesepisterna are consistently longer than the third flagellar segment. These hairs are best measured viewing the specimen in cephalic aspect.

Male. Measurements and ratios: N, 5; length, 10-13 mm.; width, 3.5-4.0 mm.; wing length, $M = 4.32 \pm 0.888$ mm.; hooks in hamulus, $M = 14.20 \pm 0.374$; flagellar segment 2/segment 1, $M = 3.77 \pm 1.065$.

Structure and color: Color as in *communis* with the following differences: Labrum with narrow dark brown apical margin; first flagellar segment and at least half of second segment dark brown, reddened lower area of remaining segments equal to less than half of width; mandibles with basal yellow spots restricted to depressed punctate basal areas or slightly larger; legs at most with tarsi rufescent; apical areas of terga not translucent or only slightly so, dark brown to black. Antennae shorter than in *communis,* not reaching apical margin of first metasomal tergum in repose; minimum length of first flagellar segment equal to about one third of maximum length of second segment, never less than one fourth of second segment. Characters of structure and punctation as in *communis* with the following differences: parapsidal lines usually short, equal to distinctly less than distance between anterior tip of line and supra-alar carina (each equal to about five sevenths of this distance); metasomal tergum 1 and interband zone of tergum 2 with coarse punctures not obscured by dense shagreening; apical areas of terga 2-4 moderately shiny, shagreened but not densely so, often with distinct punctures. Genitalia and hidden sterna as in *communis.*

Hair: Generally as in *communis* with the following differences: hairs generally longer and more flexible, lower half of lateral surface of mesepisternum with hairs distinctly longer than third flagellar

segment (view specimen in anterior aspect to measure hairs); long bristlelike hairs of terga longer; long dark hairs in apical area of tergum 2 distinctly longer than plumose hairs of distal pale pubescent band; interband zone of tergum 2 and apical area of tergum 1 with pale hairs; tergum 5 without a complete pale band.

Remarks. A single female collected near Tapanatepec, Oaxaca, on the same date as the holotype male is possibly the female of this species. This female has the punctation of the terga and the mesoscutum as in *comptoides* and the coloration of *thelypodii* or *elusa.* However, the clypeus is longer than usual and more coarsely punctate than either *thelypodii* or *comptoides.* Because of the difference in punctation of the mesoscutum, there is doubt that this is the female of *flexa.* Perhaps it is a new form, but it is best not to apply a new name until additional specimens are available.

The few males available for study are from rather widely separated localities and show considerable variation in the color of the vestiture and some variation in punctation and size. Perhaps more than one subspecies, or even species, is involved and the above mentioned female should be allied with one of these. However, until more specimens are available, one cannot assess the range of variation with any accuracy.

Type material. Holotype male and one paratype male from 4 miles E. of Tapanatepec, Oaxaca, Mexico, July 9, 1953, 700 feet altitude, Univ. of Kansas Mexican Expedition. Paratypes are as follows: 2 males from Las Puentes, Durango, July 24, 1947, C. D. Michener; 1 male from 6 miles S. W. of Puebla, Puebla, July 2, 1953, Univ. of Kansas Mexican Expedition. The female mentioned above was taken 7 miles N. E. of Tapanatepec, Oaxaca, July 9, 1953, by a Univ. of Kansas Mexican Expedition. The holotype is in the Snow Entomological Museum at the University of Kansas. Paratypes are in the Snow Entomological Museum, the American Museum of Natural History, New York City, and in the author's collection.

Melissodes (Melissodes) panamensis Cockerell.

Melissodes panamensis Cockerell, 1928, Psyche, vol. 35, p. 174 (*tepaneca* subsp.); Michener, 1954, Bull. Amer. Mus. Nat. Hist., vol. 104, p. 132 (*tepaneca* subsp.) (in part).

This species is a small Panamanian species closely resembling *tepaneca* which also occurs in Panamá. *M. panamensis* can be separated from *tepaneca* by the virtual lack of dark hairs in the apical area of the first metasomal tergum of both sexes, by the form of the eighth sternum of the male and by the punctation and

hairs of the interband zone of the second tergum of both sexes as described below.

Female. Measurements and ratios: N, 3; length, 10-11 mm.; width, 4.5-5.0 mm.; wing length, M = 3.69 ±0.355 mm.; hooks in hamulus, M =14.33 ± 0.882; flagellar segment 1/segment 2, M = 2.09 ± 0.035.

Structure and color: Integument black except as follows: flagella red beneath, except first segment; distitarsi rufescent and often basitarsi and hind tibiae rufescent. Structure and punctation as in *communis* with the following differences: supraclypeal area coarsely punctate, ground shagreened; vertex with flattened lateral areas with punctures separated mostly by less than one puncture width, ground delicately shagreened; mesoscutum coarsely punctate, small oval posteromedian area with smaller, more crowded punctures as in *comptoides;* metasomal tergum 1 with basal three to four fifths coarsely punctate, punctures separated by less than half of one puncture width; tergum 2 with interband zone with small, round, crowded, distinct punctures separated mostly by less than half of one puncture width, punctures as crowded medially as laterally, regularly spaced; apical areas of terga 2 and 3 with abundant small punctures each separated from the nearest puncture by one to three puncture widths, punctures equal in width to two to three times diameter of hairs arising from them, ground shiny to moderately shiny.

Hair: With characters of hair and pubescence of *communis* with the following differences: pale hairs of vertex and mesoscutum bright ferruginous; pale metasomal bands usually pale ferruginous; mesoscutum, scutellum, ventral and lower lateral surfaces of mesepisterna with dark reddish-brown hairs; tergum 1 usually with at least a few short appressed dark brown hairs apically; tergum 2 with interband zone equal to twice width of distal pale band across entire tergum, with erect, rather long, stiff hairs, long pubescence of basal pale band bent upwards at tips by adjacent erect hairs of interband zone; tergum 4 with small, rectangular or diamond-shaped, median, apical patch of black pubescence, in width equal to less than one fifth of width of tergum and in length equal to half or less of pale band. Legs with pale rufescent to yellow hairs except brown on fore tarsi, tips of fore tibiae and fore coxae, and orange-red on inner surfaces of basitarsi and hind tibiae.

Male. Measurements and ratios: N, 14; length, 9-12 mm.; width, 3.5-4.0 mm.; wing length, M = 2.11 ± 0.258 mm.; hooks in

hamulus, M = 13.29 ± 0.194; flagellar segment 2/segment 1, M = 8.63 ± 0.125.

Structure and color: Integumental color as in *communis,* but terga 1-4 usually with apical areas opaque, dark brown to black. Structure and punctation as in *communis* with the following differences: minimum length of first flagellar segment equal to less than one seventh of maximum length of second segment and about equal to length of pedicle; vertex between apices of compound eyes and lateral ocelli with punctation as in female but ground shiny, unshagreened; sculpturing of mesoscutum and metasomal terga 2-4 as in female; tergum 1 with basal punctate area almost reaching apical margin medially. Genitalia and hidden sterna as in *communis,* but sternum 8 with apex of median ventral carina extending well beyond apical margin of emargination.

Hair: With pubescence and hair characters of *communis* with the following differences: pale hairs and pubescence of head, thorax and metasoma ferruginous to pale ferruginous; vertex of head, mesoscutum and scutellum without brown hairs; tergum 2 with hairs of interband zone as in female, but interband zone narrower, about equal in width to distal pale band across entire tergum, hairs of interband zone all pale; terga 2-4 with hairs of apical areas as in apical areas of terga 2 and 3 of female. Legs with pale ferruginous to yellow hairs except yellowish-orange hairs of inner surfaces of tarsi.

Type material. Holotype female and allotype male from Cristóbal, Canal Zone, August 10, 1924, N. Banks, is in the Museum of Comparative Zoology, Harvard University.

Distribution. This species is known to occur only in Panamá. It has been collected from June 23 to December 24. In addition to the type material, 3 females and 14 males have been examined from the localities listed below.

Canal Zone: Balboa; Bella Vista; Chiva Chiva; Cristóbal. Panama Province: Pacora; Panamá City.

Melissodes (Melissodes) thelypodii Cockerell

This is a beautiful bee from southwestern United States, Mexico and Central America. It is distinguished from *communis* by the following characters: mesoscutum with small, close-set punctures in the posteromedian area in both sexes; first flagellar segment of the male is relatively short; mesepisterna of the female lack brown hairs below in the northern subspecies; basal area of the first meta-

somal tergum with relatively coarse punctures; mesoscutum usually with bright orange-red hairs. This species can be separated from *comptoides* by the following characters: apical areas of terga 2 to 4 relatively impunctate in both sexes; flattened lateral areas of the vertex in the female with small, round, well-separated punctures, ground usually shiny and unshagreened; interband zone of tergum 2 and apical area of tergum 1 of the male narrow, usually with only pale hairs; inner surfaces of hind basitarsi and tibiae of the female with pale, golden-red hairs; mesepisterna of the female of the northern subspecies without dark hairs below; distal pale band of tergum 2 of the female usually broader, at least laterally.

Female. Structure and color: Integument usually black; legs often bright red, at least distitarsi red in dark specimens; each sternum hyaline apically, basal sterna often wholly red; flagellar segments 3 to 12 red below, dark brown to black above; eyes gray to grayish-blue, rarely greenish-blue; wing membranes clear, yellowish, darker apically, veins red to dark reddish-brown. Clypeus coarsely punctate, punctures mostly round but somewhat elongate laterally, separated by less than half of one puncture width, often smaller and more crowded basally, ground shiny, delicately shagreened at least basally, without median carina or carina short and indistinct apically; supraclypeal area often with coarse punctures, ground dulled by dense shagreening; flattened area extending mesad and somewhat posterior from apex of compound eye usually with small, round, well-separated punctures, ground usually shiny; galeae and maxillary palpi as in *communis.* Mesoscutum and scutellum with punctures as in *comptoides,* but densely punctate posteromedian area usually somewhat smaller and often less distinct; sculpturing of metanotum, propodeum and lateral surfaces of thorax as in *communis.* Sculpturing of metasomal terga as in *communis,* but punctures in basal area of tergum 1 more crowded and more distinct, punctures in lateral raised areas of interband zone of tergum 2 smaller and separated mostly by less than half of one puncture width, apical areas of terga 2 and 3 impunctate or with small punctures less than twice the width of the suberect hairs arising from them and ground moderately shiny, finely shagreened; sterna densely and coarsely punctate.

Hair: Hair and color pattern are described below for each subspecies.

Male. Structure and color: Integument as in *communis,* but legs

often wholly red and at least distitarsi red in darkest specimens; apical areas of terga 1 to 4 tend to be somewhat translucent, but never clear and often opaque, piceous; clypeus and bases of mandibles bright yellow; labrum wholly whitish or pale yellow; eyes gray to grayish-blue; wings as in female. First flagellar segment short, minimum length about equal to pedicle and always shorter than one seventh of maximum length of second segment; vertex between apices of compound eyes and lateral ocelli with small round punctures separated mostly by two or more puncture widths, ground usually shiny, not shagreened. Sculpturing of mesoscutum as in *comptoides*, but densely punctate posteromedian area smaller and occasionally mesoscutum evenly punctate; sculpturing of metanotum, propodeum and lateral surfaces of thorax as in *communis*, but lateral surfaces of mesepisterna often with ground dulled by fine dense shagreening. Sculpturing of metasomal terga and sterna as in *communis*, but punctures in basal area of tergum 1 usually more distinct and more crowded, punctures in interband zone of tergum 2 smaller and more crowded laterally and more distinct medially, and apical areas of terga 2 to 4 impunctate or with small punctures, ground moderately shiny.

Genitalia as in *communis*. Sternum 7 usually with long lateral plates and short apodemes as in *comptoides*. Sternum 8 strongly emarginate medially at apex as in *communis* and usually with short lateroapical hairs as in *comptoides* (Figs. 74-76).

Bionomics. M. thelypodii is a highly polylectic species, in spite of its name, as are most species of the subgenus *Melissodes*. The author, together with R. H. and L. D. Beamer and Cheng Liang, has taken females of *thelypodii* in large numbers collecting pollen from *Solanum eleagnifolium* and *Hoffmannseggia jamesii* in New Mexico in July. These two plants are quite unrelated and belong to different families (Solanaceae and Leguminosae, respectively). It appears that *thelypodii* is important in crosspollination of alfalfa in irrigated areas of New Mexico and Arizona. The females have been collected a number of times visiting and seemingly collecting pollen from cotton. These collections have been made in localities as far separated as Tucson, Arizona, Brownsville, Texas, and Tlahualilo, Mexico. In addition, females have been taken on two other malvaceous plants—*Thurberia* and *Sphaeralcea*. Out of about thirty five collections in which specimens bear flower labels, only six were of bees visiting composites and of these six only four included

females. It is apparent that *thelypodii* is a polylectic species visiting mainly non-Compositae for pollen and shows some preference for plants of the families Leguminosae, Malvaceae and Solanaceae.

Geographical variation. This species is divided into two subspecies which are quite distinct at least in the females. The southern subspecies, occupying Central America and Mexico south of Durango, is smaller, darker in color and somewhat more coarsely punctate. Intergrades are known from southern Chihuahua. In addition to this, the females of *thelypodii s. str.* from Chihuahua and Coahuila in Mexico appear to be larger in average size than those from New Mexico and Arizona. The majority of specimens from Arizona tend to have black legs and lack reddish-brown hairs on the mesoscutum, whereas the majority of specimens from New Mexico and northern Mexico have red legs and many have at least a few brown mesoscutal hairs. These differences are not well enough established to permit recognition of additional subspecies, however. It is useful to bear in mind these geographical variations in identifying specimens from these localities.

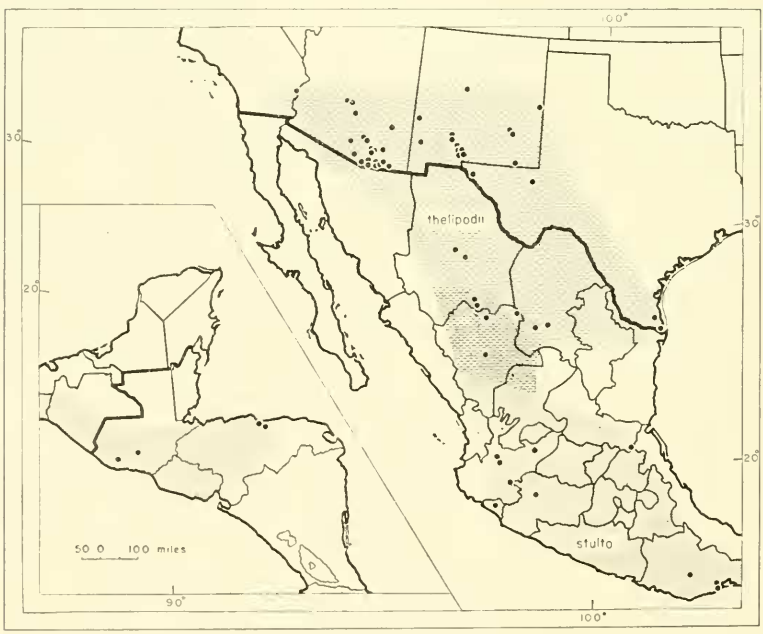

FIG. 12. Map showing the distribution of *M.* (*Melissodes*) *thelypodii.* The overlapping type of shading indicates the zone of intergradation between the two subspecies.

Melissodes (Melissodes) thelypodii thelypodii Cockerell.

Melissodes thelypodii Cockerell, 1905, Ann. Mag. Nat. Hist., ser. 7, vol. 15, p. 527; 1906, Trans. Amer. Ent. Soc., vol. 32, pp. 84, 107; 1906, Trans. Amer. Ent. Soc., vol. 32, p. 309.
Melissodes communis, Cockerell, 1898, Bull. Univ. New Mexico, vol. 1, p. 66 (misidentification); 1906, Trans. Amer. Ent. Soc., vol. 32, p. 92 (misidentification); 1906, Trans. Amer. Ent. Soc., vol. 32, p. 310 (misidentification).
Melissodes kallstroemiae Cockerell, 1905, Ann. Mag. Nat. Hist., ser. 7, vol. 16, p. 216 (new synonymy); 1906, Trans. Amer. Ent. Soc., vol. 32, p. 81; 1906, Trans. Amer. Ent. Soc., vol. 32, p. 310.
Melissodes kallstroemiae var. *phenacoides* Cockerell, 1905, Ann. Mag. Nat. Hist., ser. 7, vol. 16, p. 217 (new synonymy); 1906, Trans. Amer. Ent. Soc., vol. 32, p. 81.
Melissodes thurberiae Cockerell, 1914, Proc. Ent. Soc. Washington, vol. 16, p. 31 (new synonymy).

The subspecies *thelypodii* can be separated from the following subspecies by the lack of brown hairs on the ventral and anterior surfaces of the mesepisterna in the female and by the larger average size of both sexes. The males cannot be satisfactorily separated from those of *stulta,* but the pale hairs of the head, thorax and metasoma of *thelypodii* are usually brighter red and the apical areas of terga 2 to 4 are usually less punctate.

Female. Measurements and ratios: N, 20; length, 11-16 mm.; width, 4-6 mm.; wing length, M = 4.34 ± 0.420 mm.; hooks in hamulus, M = 15.45 ± 0.211; flagellar segment 1/segment 2, M = 2.02 ± 0.022.

Structure and color: Legs often entirely red; clypeus usually rather evenly and coarsely punctate, punctures usually not conspicuously smaller posteriorly; vertex with flattened lateral areas almost always with shiny, unshagreened or very delicately shagreened ground surface.

Hair: On head bright ferruginous at vertex, becoming ochraceous to white on face and genal areas; vertex often with a few to many long brown hairs. Thorax above with bright orange-red hairs, often with a few reddish-brown hairs in posteromedian area of mesoscutum and a few dark hairs medially on scutellum; lateral surfaces of thorax with pale ferruginous to white hairs, lateral, ventral and anterior surfaces of mesepisterna never with dark brown hairs, but ventrally may be golden to golden-brown. Metasomal banding as in *communis,* but often pale rufescent in color; distal pale band on tergum 2 usually wider than in *communis,* laterally as wide as or wider than apical apubescent area and somewhat narrowed medially; interband zone of tergum 2 narrow, usually with pale suberect hairs, dark hairs may be present in median third; tergum 1 usually without appressed dark brown hairs in apical area, except occasionally a

few laterally; tergum 3 with pale band usually wider than apical area medially; tergum 4 with pale band usually without median brown interruption, or this area very small; tergum 5 always with tufts of long white hairs laterally; sternal hairs usually red medially and white laterally, except dark brown hairs of apical two sterna and occasionally all sterna with dark hairs medially. Legs with white hairs except ochraceous to brown hairs on fore tarsi and apically on outer surfaces of middle tibiae and bright yellowish-red hairs on inner surfaces of basitarsi and tibiae.

Male. Measurements and ratios: N, 20; length, 9-15 mm.; width, 3-5 mm.; wing length, $M = 4.11 \pm 0.516$ mm.; hooks in hamulus, $M = 14.15 \pm 0.284$; flagellar segment 2/segment 1, $M = 6.84 \pm 0.098$.

Structure and color: Vertex between apices of compound eyes and lateral ocelli with punctures separated by more than one puncture width, ground shiny, unshagreened; terga 2-4 with apical areas usually impunctate, or punctures no wider than hairs arising from them.

Hair: On head and thorax as in female, but never with dark hairs on vertex or on mesoscutum and very rarely with a few reddish-brown hairs medially on scutellum. Hairs of metasomal terga much as in female, but never with dark hairs in apical area of tergum 1 and pale hairs of tergum 1 usually reach apical margin; interband zone of tergum 2 narrow, with long suberect or erect pale hairs, basal band often fused with distal band medially, rarely interband zone with dark hairs in median third or less; pale pubescent bands of terga 2-5 usually pale rufescent in color, but often white; tergum 2 with pale distal band usually wider than in *communis*, equal to one half to two times width of apical area medially; tergum 3 with pale band wider than apical area and not strongly notched medially along posterior margin; tergum 4 with pale band wider than apical area medially, usually reaching apical margin in lateral third or more, often notched medially along posterior margin but not strongly so; tergum 5 usually without a complete pale band, with long pale hairs laterally and often with lateral fasciae of pale pubescence; sternal hairs as in female. Legs with white to yellow hairs except rufescent hairs of inner surfaces of tarsi.

Type material. Holotype female of *thelypodii* from La Cueva, Organ Mountains, New Mexico, September 4, C. H. T. Townsend, is in the U. S. National Museum. Holotype male of *kallstroemiae* from Mesilla Park, New Mexico, on *Kallstroemia* sp., T. D. A.

Cockerell, is in the collection of the University of Colorado Museum, Boulder. Holotype male of *phenacoides* from Las Cruces, New Mexico, T. D. A. Cockerell, is in the collection of the University of Colorado Museum, Boulder. Holotype female of *thurberiae* from Stone Cabin Canyon, Santa Rita Mountains, Arizona, August 26, 1913, on *Thurberia thespesioides,* W. D. Pierce, is in the U. S. National Museum.

Distribution. Southern California through Arizona and New Mexico to southeastern Texas and south to northern Durango (Fig. 12). This subspecies has been collected from the end of May to November 16, but mainly in July and August. In addition to the type material, 245 females and 139 males have been examined from the localities listed below. This list includes localities reported in the literature.

Arizona: Arivaca; Benson; Douglas; Hereford; Huachuca Mts.; Kits Peak, Baboquivari Mts.; Madera Canyon, Santa Rita Mts.; Marana; Mesa; Nogales; Pajarita Mts.; Palmerlea; Patagonia; Phoenix; Ramsey Canyon, Huachuca Mts.; Sacaton; Santa Rita Mts.; Stone Cabin Canyon, Santa Rita Mts.; Tucson; Thatcher. California: Blythe. New Mexico: Alma (5 miles N.); Dona Ana Co.; Garfield; Hatch; Isleta; Las Cruces; Lordsburg (25 miles E.); Mesilla; Mesilla Park; Portales; Radium (5 miles N.); Roswell (5 miles S. and 10 miles W.); San Ignacio; White's City, Eddy Co. Texas: Brownsville; Fabens; Pecos (10 miles N.); Raymondsville. Chihuahua: * Catarinas; * Charcos (16 miles S. E.); Chihuahua; Meoqui (6 miles E.). Coahuila: Cabos; Paila. Durango: * San Juan del Río; Tlahualilo.

Flower records. Asclepias sp., *Astragulus* sp., *A. cottonii, Baccharis glutinosa, Chamaesarcha coronopus, Cirsium* sp., *Convolvulus* sp., *Gaillardia* sp., *Gossypium herbaceum, Helianthus annuus, Hoffmannseggia jamesii, Ipomoea mexicana, Kallstroemia* sp., *K. grandiflora, Larrea* sp., *Lippia cuneifolia, Lygodesmia juncea, Medicago sativa, Melilotus* sp., *Solanum* sp., *S. eleagnifolium, Sphaeralcea* sp., *Thelypodium linearifolium, Thurberia thespesioides, Wedeliella incarnata.*

Melissodes (Melissodes) thelypodii stulta, subsp. nov.

This is a small subspecies from southern Mexico and Central America. Due to their small size and dark mesepisternal hairs, the females of this subspecies resemble those of *Melissodes tepa-*

* Localities considered as in the zone of intergradation.

neca to a remarkable degree. The females of *stulta* are distinguished from those of *tepaneca* by the distal pale band of tergum 2 which in *stulta* is relatively strongly arched and slightly wider laterally than medially and is as wide as or wider than the interband zone of tergum 2. Also, *stulta* does not have a large diamond-shaped medial patch of brown pubescence on tergum 4, the brown pubescence, if present, is usually restricted to a small apical oval or triangular spot. The subspecies *stulta* can be separated from *thelypodii s. str.* by the characters listed in the diagnosis of the latter.

Female. Measurements and ratios: N, 20; length, 9-13 mm.; width, 3-5 mm.; wing length, M = 3.59 ± 0.441 mm.; hooks in hamulus, M = 14.75 ± 0.084; flagellar segment 1/segment 2, M = 1.97 ± 0.020.

Structure and color: Legs black except rufescent distitarsi and often rufescent basitari. Clypeus often with smaller and more crowded punctures posteriorly and laterally; vertex with flattened lateral areas with small punctures separated mostly by one puncture width, ground dulled by shagreening; mesoscutum with posteromedian area densely punctate as in *comptoides*; interband zone of metasomal tergum 2 with punctures slightly smaller and more crowded medially than in *thelypodii*; apical areas of terga 2-4 with abundant punctures mostly as wide as twice the basal diameter of hairs arising from them.

Hairs: On vertex always with at least a few dark hairs; mesoscutum usually with large patch of dark brown hairs and rarely without at least a few dark hairs in posteromedian area; scutellum usually with dark brown hairs medially; tegulae often with dark brown hairs; mesepisterna with dark brown hairs at least on ventral surfaces and usually on lower anterior and lower lateral surfaces as well; tergum 2 often with dark brown hairs in median half of interband zone; usually coxae and often hind femora and outer surfaces of middle tibiae with dark brown hairs.

Male. Measurements and ratios: N, 10; length, 11-12 mm.; width, 3-4 mm.; wing length, M = 3.56 ± 0.314 mm.; hooks in hamulus, M = 12.90 ± 0.277; flagellar segment 2/segment 1, M = 7.59 ± 0.242.

Structure and color: Legs black except rufescent distitarsi and often rufescent basitarsi. Vertex laterally often with ground dulled by shagreening; mesoscutum more densely punctate than in most specimens of *thelypodii*; metasomal terga 2-4 with apical areas often

with rather coarse punctures equal in width to about twice basal diameter of hairs arising from them.

Hair: Mesoscutum and scutellum often with a few reddish-brown hairs medially; tergum 5 rarely with pale pubescent band complete, usually broadly interrupted medially or absent; tergum 1 often with a few dark brown hairs in apical area; apical areas of terga 2-4 with dark brown to black hairs.

Remarks. Four males from the state of San Luis Potosí seemingly belong to this subspecies. However, since the males cannot be definitely identified, these specimens are only provisionally placed with this subspecies until females from that area can be studied. A single female from the state of Durango is typically *stulta* in size and color. It is probably from the zone of intergradation with *thelypodii*, wherein all variants from one extreme to the other may be expected to occur. Six females from the state of Oaxaca have much redder mesoscutal hairs than most females from Jalisco and Michoacán, but these appear to be younger individuals and the dullness of the northern females may be due to fading with age, a process known to occur in other species.

Five females and one male from Honduras are very small, ranging from nine to ten millimeters in length. The females of this series have more brown hairs in the interband zone of tergum 2 than usual and the mesoscutal hairs are red, as in the Oaxacan specimens. Two females from Guatemala are intermediate in size between the Oaxacan and Honduras specimens, being about as small as the smallest of the former (10 mm. in length). Perhaps a southern subspecies could be recognized with the Oaxacan and Guatemalan specimens being considered as from the zone of intergradation. However, the size difference is the only usable character and from the small amount of material available, there appears to be a rather smooth cline in size. Considering the great variability in size which occurs in other species of *Melissodes*, and which can be readily seen in a long series of *thelypodii s. str.* from New Mexico, one can expect this gradient in size to be disrupted by additional material from Central America.

Type material. Holotype female collected by H. E. Evans, 8 kilometers east of Tequila, Jalisco, Mexico, July 18, 1951, and the allotype male taken by H. E. Evans, at Villa Quadelupe, Jalisco, July 26, 1951. Paratypes from Mexico are as follows: Villa Guadelupe, Jalisco, 3 females and 2 males on *Asclepias* sp., July 25, 1951, 1 female and 1 male on *Asclepias* sp., 1 female without flower data,

July 26, 1951, P. D. Hurd; San Juan de los Lagos, Jalisco, 1 female, July 27, 1951, P. D. Hurd; Tizapán, Jalisco, 2 females, July 18, 1953, Univ. of Kansas Mexican Expedition; Jacona, Michoacán, (3 miles W.), 1 female, July 18, 1953, Univ. of Kansas Mexican Expedition. The holotype and allotype are in the Snow Entomological Museum at the University of Kansas. Paratypes are in the collections of the Snow Entomological Museum, the University of California, Berkeley, and in the author's collection.

Distribution. From the states of Durango and San Luis Potosí in Mexico south through Guatemala and into Honduras (Fig. 12). Localities from which specimens have been examined, aside of the type material, are listed below. Those localities which are probably in the zone of intergradation are marked with asterisks.

COLIMA: One male without more definite location on the label. DURANGO: * Encino. OAXACA: Salina Cruz; Tehuantepec (6 miles S.); Totolápam. SAN LUIS POTOSI: Tamazunchale. GUATEMALA: Variedades, Suchitepéquez. HONDURAS: La Ceiba, Colón.

Flower records. Both males and females have been collected on *Asclepias* sp., but no other flower records exist.

Melissodes (*Melissodes*) *cestus* Krombein.

Melissodes cestus Krombein, 1953, Amer. Mus. Nov., no. 1633, p. 26.

This species is closely related to *M. communis* and to *M. comptoides*. The females differ from those of *communis* by the sculpturing of the clypeus and the metasomal terga, as described below, and from the females of *comptoides* by the punctation of the mesoscutum. The males differ from those of *communis* by the shorter first flagellar segments and by the tergal punctation, and from the males of *comptoides* by the punctation of the mesoscutum. In addition, both sexes of *cestus* differ from *communis* and *comptoides* by having wider apical bands on tergum 2. *M. cestus* can be easily differentiated from other species of the subgenus *Melissodes* occurring in the West Indies by characters summarized in the key and discussed in the diagnosis of each of these species. It is more closely related to *M. cubensis* than to any other West Indian species.

Female. Measurements and ratios: N, 1; length, 11 mm.; width, 4.5 mm.; wing length, 3.85 mm.; hooks in hamulus, 17; flagellar segment 1/segment 2, 1.91.

Structure and color: Black, distitarsi dark reddish-brown; tegulae dark brown; antennae black, flagella slightly paler beneath than above, but not reddish as in most species of the subgenus; wing

membranes slightly infumate, clear brown; veins dark reddish-brown to black; eyes grayish-black. Clypeus coarsely punctate, punctures separated mostly by half or less of one puncture width, ground areas and bottoms of punctures opaque, dulled by dense tessellations; supraclypeal area with abundant punctures laterally, dulled by dense shagreening; vertex with flattened lateral areas with distinct punctures separated mostly by less than one puncture width, ground shagreened, moderately shiny. Sculpturing of thorax as in *communis,* but impunctate area of declivous face of propodeum much larger and extending onto basal face medially where there are only one or two punctures present at extreme base. Sculpturing of metasoma as in *comptoides,* but punctures in apical areas of terga 2 and 3 slightly smaller, although abundant and separated mostly by one to three puncture widths.

Hair: On head white except abundant black hairs on vertex and upper third or half of face. Thorax with hair characters of *communis* except as follows: no dark hairs below on mesepisterna; tegulae with abundant dark hairs; mesoscutal patch of dark hairs within 3 to 4 hairs of tegulae and extending forward to a transverse line at anterior margins of tegulae; pale hairs of thorax white. Hair character of metasoma as in *communis* except as follows: tergum 1 with pale hairs white; tergum 2 with pale distal band broader, laterally as broad as apical area and medially as wide as half of apical area; terga 2 and 3 with more abundant dark brown or black appressed hairs in apical areas. Legs with white hairs except black or dark brown on fore and middle tibiae apically and on basitibial plates, and inner surfaces of hind basitarsi and tibiae with rufescent hairs; scopal hairs white.

Male. Measurements and ratios: N, 1; length, 9.5 mm.; width, 3.5 mm.; wing length, 3.57 mm.; hooks in hamulus, 15; flagellar segment 2/segment 1, 6.38.

Structure and color: Color as in female except as follows: labrum white; clypeus and large basal mandibular spots yellow; flagella below, except first segment, red, first segment and upper and lateral surfaces dark brown to black; basitarsi dark reddish-brown. Sculpturing as in female, but mesoscutal punctures somewhat more crowded. Minimum length of first flagellar segment equal to about one seventh of maximum length of second segment or slightly less.

Genitalia essentially as in *communis;* gonostyli with somewhat sparser hairs; spatha somewhat more angulate laterally. Sternum 7 as in *communis.* Sternum 8 not emarginate apically, or only slightly

so, without apical hairs, shorter and broader than in *communis* (see Krombein, 1953, for illustrations of the male terminalia).

Hair: On head pale ochraceous to white except abundant dark brown hairs on vertex. Thorax above with ochraceous hairs, a large square mesoscutal patch of dark brown hairs, a large scutellar patch of dark hairs, and tegulae with brown hairs above; lateral surfaces of thorax with pale ochraceous to white hairs. Metasomal hairs as in *comptoides,* except distal pale band of tergum 2 as wide as or wider than apical area laterally and as wide as half of apical area medially; tergum 5 with tufts of white hairs laterally, without a pale pubescent band; sternal hairs dark brown except tufts of pale hairs laterally. Legs with white hairs except as follows: distitarsi and inner surfaces of basitarsi with rufescent hairs; basitibial plates with brown hairs; hind tibiae with brown hairs extending from basitibial plates along basal two thirds or more medially on outer surfaces.

Type material. Holotype male from South Bimini Island, Bahamas, May, 1951 (Cazier and Gertsch) and allotype female from same locality, June, 1951 (M. Cazier and C. and P. Vaurie), are in the American Museum of Natural History, New York City. One male paratype collected with the holotype and one female paratype collected with the allotype, both are in the U. S. National Museum.

Melissodes (Melissodes) cubensis, sp. nov.

This species, known only in the male sex, is closely related to *M. communis* from which it is distinguished by the mandibular yellow spots being small or absent, by the generally ferruginous vestiture and by the form of the median ventral carinae of the eighth sternum. Of the West Indian species of the subgenus *Melissodes, cubensis* is most closely related to *leprieuri* and *martiniccnsis* from which it can be distinguished by the color of the hairs of the head and thorax and by the punctation of the mesoscutum and metasomal terga. One dark specimen of *cubensis* superficially resembles the male of *foxi* due to the interrupted distal pale band of the second tergum. These can be distinguished by the more dense hairs of the outer surfaces of the hind tibiae and by the relatively long first flagellar segments of *cubensis.*

Male. Measurements and ratios: N, 4; length, 12-13 mm.; width, 3.5-4.0 mm.; wing length, $M = 3.69 \pm 0.045$ mm.; hooks in hamulus, $M = 12.50 \pm 0.647$; flagellar segment 2/segment 1, $M = 5.63 \pm 0.439$.

Structure and color: Integument black except as follows: labrum yellow; clypeus yellow; bases of mandibles at most with a small yellow triangular spot smaller than the depressed triangular area (absent in holotype); antennae dark reddish-brown, flagella somewhat pale below; eyes gray to black; legs and metasomal sterna usually dark red, distitarsi and tibiae often paler; wing membranes infumate, yellow, veins dark reddish-brown. Minimum length of first flagellar segment equals one seventh to one sixth (holotype) of maximum length of second segment; eyes in facial view somewhat longer than twice width, converging slightly below; clypeus with small round punctures separated by one to one half of one puncture width, ground coarsely shagreened; supraclypeal area with round distinct punctures at least laterally and usually medially as well, ground tessellate; vertex between lateral ocelli and apices of compound eyes with deep round punctures separated by one to two puncture widths, ground smooth and shiny. Mesoscutum with crowded punctures in anterior half, lateral third of posterior half and in short declivous posterior area, posteromedian area impunctate or virtually so, ground shiny, delicately or not at all shagreened; scutellum with smaller, more crowded punctures than in adjacent area of mesoscutum, punctures separated mostly by less than half of one puncture width, ground delicately shagreened; dorsal face of propodeum with large shiny-bottomed punctures, distinct apically and becoming reticulopunctate basally, declivous and lateral faces coarsely punctate except large inverted triangular area of upper half or more of declivous face, ground dulled by dense shagreening, but impunctate triangle of declivous face moderately shiny. Metasomal sculpturing as in *communis*, but punctures of basal area of tergum 1 and of interband zone of tergum 2 larger, separated mostly by one puncture width or slightly more, and apical areas of terga 2 to 4 with small piliferous punctures equal in diameter to two to three times basal width of hairs arising from them, ground finely shagreened, moderately shiny.

Genitalia and hidden sterna as in *communis* with the following differences: sternum 7 with ventral fold of median plates usually narrower, with ventral carinae below median apical emargination each bent at about half their length so that together they form a broadly Y-shaped structure, rather than V-shaped as in *communis*; sternum 8 with apical margin truncate or gently emarginate and usually with shorter hairs than in *communis* (Fig. 73).

Hair: On head and thorax rufescent; scutellum and usually mesoscutum with small patches of dark reddish-brown hairs. Metasoma

with characters of vestiture of *communis* with the following differences: pubescent bands pale rufescent rather than white; bands on terga 2 and 4 may be interrupted medially by reddish-brown pubescence (not in holotype), but usually not; tergum 5 without a complete pale band. Legs with rufescent hairs, occasionally with brownish hairs medially on outer surfaces of tibiae below and on basitibial plates.

Type material. Holotype male from El Cano, Cuba, November 6, 1931, collected by L. C. Scaramuzza. Three male paratypes from Cuba as follows: Cabañas, Piñar del Río, September 5-8, 1913; 7 kilometers north of Viñales, P. del Río, September 16-22, 1913; Piñar del Río, P. del Río, September 9-24, 1913. The holotype is in the Snow Entomological Museum at the University of Kansas. Two paratypes are in the American Museum of Natural History, New York City, and one paratype is in the author's collection.

Melissodes (Melissodes) foxi Crawford

Melissodes foxi Crawford, 1915, Proc. U. S. Nat. Museum, vol. 48, p. 577.
Melissodes mimica, Fox, 1891, Trans. Amer. Ent. Soc., vol. 18, p. 347 (misidentification).
Melissodes trifasciata, Fox, 1891, Trans. Amer. Ent. Soc., vol. 18, p. 347 (misidentification).

This is a very distinctive species which is not closely related to any other species of the subgenus, but belongs near *communis*, according to the characters of the male terminalia. The female is characterized by having distinctly punctate apical areas on terga 2 and 3, a sparsely punctate mesoscutum, abundant dark brown hairs on vertex, mesoscutum, scutellum and tegulae, and a broadly interrupted distal pale pubescent band on metasomal tergum 2. The males are similarly characterized, but have much less brown hair on the head and thorax and, in addition, have very sparse, relatively short hairs on the outer surfaces of the tibiae, a brown margin on the yellow labrum and very short first flagellar segments.

Female. Measurements and ratios: N, 4; length, 9-12 mm.; width, 3.5-4.0 mm.; wing length, $M = 3.69 \pm 0.596$ mm.; hooks in hamulus, $M = 14.00 \pm 0.435$; flagellar segment 1/segment 2 (N, 3) $M = 2.02 \pm 0.020$.

Structure and color: Integument black except as follows: distitarsi rufescent and often legs entirely red or dark reddish-brown; mandibles red medially; flagella red beneath; sterna red at least basally; apical areas of terga very dark reddish-brown; eyes green to yellowish-green; wing membranes slightly infumate, veins dark

reddish-brown. Clypeus with small punctures separated mostly by about one half of one puncture width, somewhat elongate laterally and smaller and more crowded medioanteriorly, ground dulled by coarse shagreening; supraclypeal area with few or no punctures medially, ground dulled by coarse, reticular shagreening; flattened lateral areas of vertex with abundant small round punctures separated by one to two puncture widths, ground shagreened; eyes in facial view slightly broader than three times length. Thoracic sculpturing as in *communis* with the following differences: posteromedian area of mesoscutum virtually impunctate, sometimes a few punctures along midline, ground smooth and shiny; ground area of lateral surfaces of mesepisterna dulled by fine shagreening. Sculpturing of metasoma as in *comptoides* with the following differences: basal area of tergum 1 less coarsely punctate, ground dulled by dense fine shagreening; tergum 2 with punctures of interband zone smaller, round, separated by two to three puncture widths medially and by about one puncture width on lateral raised areas; apical areas of terga 2 and 3 and beneath apical brown hair patch in middle of tergum 4 with abundant small round punctures separated by one to three puncture widths, distinct but no larger than two to three times width of hairs arising from them.

Hair: Vestiture of head, thorax and metasoma, except for brown hairs where present, rufescent to dark ochraceous. Vertex of head, face laterad of antennal fossae, and usually clypeus with abundant dark brown hairs. Mesoscutum with large patch of dark brown hairs extending forward to a transverse line at anterior margins of tegulae and laterally to or beyond parapsidal lines; scutellum with large dark brown patch equaling about half of dark mesoscutal patch in size; tegulae with abundant dark brown hairs; mesepisterna usually with a few to several brown hairs ventrally. First metasomal tergum with abundant pale hairs in basal half; apical areas of terga 1-3 and median apical triangular patch on tergum 4 with abundant, short, appressed or subappressed, dark brown hairs; pale metasomal bands as in *communis*, but rufescent in color and distal pale band of tergum 2 broadly interrupted to form two thin lateral fasciae each equaling in length less than one third of width of tergum, these not connected to basal pale band at extreme sides; sternal hairs dark brown. Legs with dark brown hairs except as follows: dorsal surfaces of femora usually with ochraceous hairs; scopal hairs yellow to orange; inner surfaces of hind basitarsi and tibiae with yellow to red hairs; distitarsi with rufescent hairs.

Male. Measurements and ratios: N, 13; length, 8-10 mm.; width, 3-4 mm.; wing length, M = 3.42 ± 0.220 mm.; hooks in hamulus, M = 12.38 ± 0.181; flagellar segment 2/segment 1, M = 7.57 ± 0.120.

Structure and color: Integument black except as follows: clypeus yellow; labrum pale yellow with distinct brown apical margin; bases of mandibles with large triangular yellow spots; antennal scapes dark red to brown, flagella dark red above, paler beneath; legs except coxae bright red; tegulae dark reddish-brown; apical areas of terga very dark reddish-brown to black; eyes gray to yellowish-green; wing membranes clear, yellowish, veins dark reddish-brown. Minimum length of first flagellar segment equals one eighth or less of maximum length of second segment, scarcely, if at all, longer than pedicle; eyes in facial view slightly more than one third as wide as long. Sculpturing as in female with the following differences: clypeus with less distinct punctures; vertex between lateral ocelli and compound eyes with punctures of same size as in female but separated by two to three puncture widths, ground smooth and shiny; mesoscutum usually with somewhat more abundant punctures, but posteromedian area virtually impunctate; terga 2 to 4 with punctures of apical areas less abundant to absent, most abundant and distinct on tergum 2.

Genitalia as in *communis;* gonostyli with hairs near base relatively short, not nearly reaching apices of gonostyli. Sternum 7 with rather straight lateral margins; apodemes narrow and not capitate or truncate apically; median ventral carinae broad, forming a V-shaped structure. Sternum 8 only slightly emarginate apically, with several short apical hairs; ventral longitudinal carina reaches apex of sternum; lateral apodemes narrow, bent anteriorly so that small anterior process is directed somewhat medially.

Hair: Generally rather sparse; on outer surfaces of tibiae hairs relatively short and not hiding surfaces, on hind tibiae not hiding surfaces below basitibial plates. Color of vestiture as in female with the following differences: head without dark hairs or these restricted to vertex; mesoscutal and scutellar patches of dark hairs smaller; tegulae without dark brown hairs; lateral fasciae of tergum 2 (remains of distal pale band) longer, often each more than one third of width of tergum, usually connected with basal pale band at extreme sides by long appressed pale hairs; sternal hairs pale laterally and apically on each sternum. Legs with ochraceous hairs except as follows: rufescent on inner surfaces of basitarsi and hind tibiae; often dark brown medially on outer surfaces of hind tibiae below basitibial plates.

Type material. Holotype female from Portland, Jamaica, W. J. Fox collection, is in the U. S. National Museum (U. S. N. M. Type No. 18179). Four paratype females from Portland, Jamaica, and three paratype males from Jamaica from the W. J. Fox collection also in the U. S. National Museum.

Distribution. Jamaica. In addition to the type material four females and thirteen males have been examined. The data on these specimens are listed below.

Jamaica: George's Valley, Manchester, 1 female, January 8, 1920; Kingston, Fox collection, 1 female and 1 male; Portland, Fox collection, 2 females and 3 males; Rio Grande River, 9 males.

Melissodes (Melissodes) martinicensis Cockerell

Melissodes martinicensis Cockerell, 1917, Ann. Mag. Nat. Hist., ser. 8, vol. 20, p. 303.

This species, known only from the holotype male, can be distinguished from other members of the subgenus *Melissodes* occurring in the West Indies by the relative lengths of the first two flagellar segments, the punctation of the mesoscutum and metasomal terga and the distribution of dark hairs on the head and thorax as described below. Although its exact position is in doubt because the genitalia have not been studied, *martinicensis* is probably more closely related to *M. leprieuri* and *M. cubensis* than to the other West Indian species of *Melissodes*. The following description, taken from the holotype, will supplement the original description.

Male. Structure and color: Integument black; clypeus, labrum and spots at bases of mandibles yellow; legs dark red; wing membranes slightly infumate, yellowish, veins dark red; tegulae clear yellowish-red. Clypeus with coarse punctures, elongate medially, ground areas coarsely shagreened; vertex between lateral ocelli and apices of compound eyes with small punctures separated by 2 to 3 puncture widths; galeae smooth and shiny with scattered punctures; minimum length of first flagellar segment equals about one sixth of maximum length of second segment and about one fourth of third segment. Mesoscutum with round, deep, rather evenly spaced punctures separated by 1 to 2 puncture widths or less, ground areas smooth and shiny; scutellum with punctures separated by 1 puncture width or less, ground areas smooth and shiny; lateral surfaces of mesepisterna with punctures similar to those on mesoscutum, separated mostly by one puncture width; dorsal face of propodeum with large, round, mostly confluent punctures with shiny bottoms, ground areas, where they occur, dulled by coarse sha-

greening; hamuli each with 13 hooks. Metasomal tergum 2 with punctures of interband zone large, round, with indistinct posterior borders and separated by one puncture width or less; apical areas of terga 2-5 with small punctures scarcely larger than bases of hairs arising from them; sterna densely punctate, ground areas smooth and shiny.

Hair: On head pale ochraceous except abundant dark brown hairs on vertex. Thoracic hairs pale ferruginous above and ochraceous laterally except small patches of brown hairs on mesoscutum and scutellum; tegulae without dark hairs. Metasomal banding as in *communis* with the following differences: tergum 1 with basal four fifths medially and one half laterally with long ochraceous hairs, apical area with short, subappressed, simple, dark brown hairs; tergum 2 with distal pale band equal to less than one half of apical area medially, interband zone with dark brown hairs. Legs with white to pale ochraceous hairs except yellow hairs of inner surfaces of hind basitarsi and tibiae.

Type material. Holotype male from Martinique, French West Indies, July 15, A. Busck, is in the U. S. National Museum (U. S. N. M. Type No. 22898).

Melissodes (Melissodes) blanda, sp. nov.

This is a distinct species which is most closely related to *M. tepida* than to any other *Melissodes*. The males have relatively long first flagellar segments and distinct terminalia as described below. Both sexes can be distinguished by the generally pale color of the vestiture, the broad distal pale band of tergum 2, the relatively impunctate metasomal terga which are dulled by dense, fine shagreening, the coarsely punctate lateral areas of the vertex, the dark tegulae and the clear wing membranes.

Female. Measurements and ratios: N, 1; length, 11 mm.; width, 4 mm.; wing length, 3.64 mm.; hooks in hamulus, 17; flagellar segment 1/segment 2, 2.00.

Structure and color: Integument generally black, distitarsi, middle and hind basitarsi, mandibles medially, flagellar segments 2-10 beneath and basal sterna rufescent; eyes grayish-green; wing membranes clear, veins dark brown to black; tegulae piceous; tergum 1 with extremely narrow apical subhyaline margin, yellowish brown. Clypeus with fine regular punctures separated by half of one puncture width or less, except shiny impunctate median boss in apical third, moderately shiny, ground spaces with delicate

shagreening; supraclypeal area with several distinct round punctures medially, ground areas dulled by fine shagreening; vertex with lateral flattened areas extending mesad and somewhat posteriorly from apices of compound eyes with round punctures separated mostly by half of one puncture width, obscured by coarse irregular shagreening dulling ground areas; maxillary palpal segments in ratio of about 3:2:2.5:1.3. Thoracic sculpturing as in *communis* with the following differences: mesoscutum with posteromedian area with punctures separated mostly by one to two puncture widths; lateral surfaces of mesepisterna with punctures separated by less than half of one puncture width, ground dulled by delicate sparse shagreening; dorsal face of propodeum with distinct crowded punctures apically, reticulopunctate basally, moderately shiny. Basal half or slightly more of metasomal tergum 1 with large, shallow punctures separated mostly by one puncture width or slightly less medially and obscured by dense shagreening; tergum 2 with interband zone virtually impunctate medially, lateral raised areas with shallow punctures separated mostly by one puncture width, ground dulled by dense shagreening; basal areas of terga 3 and 4 similar to lateral raised areas of tergum 2 but with smaller and more abundant punctures; apical areas of terga 2 and 3 impunctate, dulled by fine, dense shagreening.

Hair: Pale hairs of head and thorax grayish-white; vertex with abundant long black hairs; mesoscutum with black and white hairs mixed in posteromedian area, dark patch contained well within parapsidal lines laterally and extending forward to a transverse line at about middle of tegulae; scutellum with abundant brown to black hairs medially; mesepisternal hairs white, no dark hairs below. Metasomal terga as in *communis* with the following differences: tergum 2 with basal and distal pale bands connected at sides, distal band medially equal to about two thirds of apical areas and laterally to about apical area or more in width, interband zone with sparse subappressed black hairs; tergum 3 with apical area about equal to that on tergum 2 in width; apical areas of terga 2 and 3 with abundant suberect black hairs; tergum 4 with large triangular median patch of suberect black hairs at apex; tergum 5 with tufts of long white hairs at sides; sternal hairs dark reddish-brown, white laterally near apex of each sternum except the last. Legs with pale ochraceous to white hairs except as follows: outer surfaces of fore tarsi, apices of middle tibiae and basitibial plates brown; inner surfaces of tarsi and hind tibiae yellow to red.

Male. Measurements and ratios: N, 11; length, 9-11 mm.; width,

3-4 mm.; wing length, M = 3.45 ± 0.311 mm.; hooks in hamulus, M = 14.09 ± 0.415; flagellar segment 2/segment 1, M = 4.68 ± 0.152.

Structure and color: Integument black except as follows: clypeus and basal half of mandible yellow; labrum white; distitarsi and usually basitarsi rufescent; apical margins of sterna hyaline; tergum 1 with exceedingly narrow hyaline, yellowish-brown, apical margin; apices of terga 2-4 slightly paler than basally, dark brown; antennal flagella yellow to red below, dark reddish-brown to black above; supraclypeal area occasionally with a small apical transverse yellow macula; wing membranes clear, veins dark reddish-brown to black; tegulae piceous. Minimum length of first flagellar segment equal to about one fifth of maximum length of second segment; maxillary palpal segment as in female, fourth segment occasionally longer; sculpturing of head and thorax as in female with the following differences: clypeal sculpturing obscure, mesoscutal punctures more abundant, lateral surfaces of mesepisterna often more coarsely shagreened. Metasomal sculpturing as in female with the following differences: tergum 1 with basal four fifths punctate; tergum 2 with more distinct punctures in interband zone medially.

Terminalia as in *communis;* dorsal carina of gonocoxite angular apically, short, gonocoxite extends considerably beyond apex of carina; spatha broadly rounded laterally, gently emarginate medially. Sternum 7 with large flattened median plates which are rhomboidal in outline in ventral view and almost as wide as lateral plates at level of middle of median plates; ventral carinae very thick, together forming a broad V-shaped structure. Sternum 8 as in *gilensis* but with shorter apical hairs and with apodemes of *comptoides* (Figs. 96-97).

Hair: On head grayish-white, pale ochraceous on vertex; vertex without dark hairs. Pale hairs of thorax grayish-white laterally and below, grayish-white to pale ochraceous above; scutellum with abundant brown hairs medially; mesoscutum with few or no brown hairs in posteromedian area. Metasomal vestiture as in female with the following differences: tergum 4 with black suberect hairs in apical area as in tergum 3; tergum 5 with complete pale pubescent apical band, usually with suberect dark brown hairs apically in median third; tergum 6 with a few long pale hairs laterally; sternal hairs white apicolaterally, yellowish-brown medially. Legs with white to pale ochraceous hairs except yellow to red on inner surfaces of tarsi.

Type material. Holotype male, allotype female and four male paratypes from 5 miles east of Brownsville, Texas, April 13, 1950, on *Borrichia frutescens,* L. D. and R. H. Beamer, C. D. Michener, W. P. Stephen, B. L. and J. G. Rozen. Two additional male paratypes collected on *Opuntia* sp. at the same time and place as the above. Four additional male paratypes are as follows: Boca Chica, Cameron Co., Texas, 1 male, April 13, 1950, on *Gaillardia* sp., by the collectors listed above; 21 miles south of Sarita, Texas, 2 males, April 17, 1952, on *Sphaeralcea* sp., L. D. and R. H. Beamer, C. D. Michener, W. E. LaBerge and Alvaro Wille; Ardmore, Oklahoma, 1 male, June 25, 1908, F. C. Bishopp (Fig. 19). The holotype and allotype are in the Snow Entomological Museum at the University of Kansas. Paratypes are in the Snow Entomological Museum, the U. S. National Museum and in the author's collection (Fig. 19).

Melissodes (*Melissodes*) *comptoides* Robertson.

Melissodes comptoides Robertson, 1898, Trans. Acad. Sci. St. Louis, vol. 8, p. 52; 1905, Trans. Amer. Ent. Soc., vol. 31, p. 369; Cockerell, 1906, Trans. Amer. Ent. Soc., vol. 32, p. 80; Robertson, 1928, Flowers and Insects, p. 8; Brimley, 1938, Insects of North Carolina, p. 462; Michener, 1947, Amer. Mid. Nat., vol. 38, p. 453.

Melissodes martini hitei Cockerell, 1908, Ann. Mag. Nat. Hist., ser. 8, vol. 2, p. 33 (new synonymy); 1909, Can. Ent., vol. 41, p. 129; 1925, Ann. Mag. Nat. Hist., ser. 9, vol. 16, p. 233; 1927, Ann. Ent. Soc. Amer., vol. 20, p. 396; Rau, 1933, Trans. Acad. Sci. St. Louis, vol. 28, p. 221.

This species is closely allied to *M. communis* and *M. thelypodii.* The males of *comptoides* can be distinguished from those of *communis* by the shorter first flagellar segments and by the more coarsely punctate mesoscutum and apical areas of the metasomal terga. They can be separated from the males of *thelypodii* by the more coarsely punctate apical areas of the terga, by always lacking a white pubescent band on tergum 5, by almost always having dark brown to black hairs apically on the terga and in the interband zone of tergum 2 and by having the vertex between the lateral ocelli and the apices of the compound eyes punctate and usually shagreened. The females are distinguished from those of *communis* by the more coarsely punctate mesoscutum and apical areas of the terga. They can be distinguished from females of *thelypodii* by the more coarsely punctate apical areas of the terga and by the presence of dark brown to black hairs at least on the ventral surfaces of the mesepisterna and usually on the lower anterior and lower lateral surfaces as well. In addition, the females often have dark reddish-brown to black hairs on the inner surfaces of the hind basitarsi and the flattened

areas of the vertex are coarsely punctate and dulled by dense shagreening.

Female. Measurements and ratios: N, 20; length, 12-15 mm.; width, 5.0-6.5 mm.; wing length, M = 4.65 ± 0.363 mm.; hooks in hamulus, M = 17.05 ± 0.256; flagellar segment 1/segment 2, M = 2.03 ± 0.021.

Structure and color: Integument black; distitarsi and lower surfaces of flagella except first segments rufescent; often hind basitarsi and tibiae and fore, middle and hind femora rufescent, especially in specimens with more than usual dark hairs; eye color variable, from gray to blue or yellowish-green, occasionally brownish or somewhat violet; wings dark, membranes infumate, yellowish-brown to dark brown, veins dark brownish-red to black, darker apically. Punctation of face as in *communis,* but clypeus usually more evenly rounded, often without a median carina and usually more densely shagreened; flattened areas of vertex just mesad of apices of compound eyes with round, deep punctures separated by one and usually less puncture width, ground dulled by dense shagreening; supraclypeal area usually coarsely punctate and shagreened; eyes, galeae and maxillary palpi as in *communis.* Mesoscutal punctures small, crowded anteriorly and laterally, becoming larger and less crowded medially (separated by about one puncture width in posteromedial area) and then becoming quite suddenly smaller and much more crowded posteriorly (separated by half or less of one puncture width), this area of crowded punctures not confined to the short declivous posterior area of mesoscutum, but extending forward medially onto flattened dorsal surface; scutellum, metanotum, propodeum and lateral surfaces of thorax as in *communis,* but lateral surfaces of mesepisterna with ground usually dulled by delicate shagreening. First metasomal tergum with round, more distinct punctures than in *communis* and separated by about one puncture width medially; terga 2-4 punctate much as in *communis* basally, but tergum 2 with coarser and larger punctures especially medially in interband zone, and apical areas of terga 2 and 3 with abundant piliferous punctures usually as wide as 3 to 4 times basal width of hairs arising from them, ground with dense fine shagreening, but usually moderately shiny.

Hair: On head and thorax as in *communis* with the following differences: vertex of head always with brown hairs; dorsum of thorax with ochraceous to bright rufescent hairs, scutellum and mesoscutum usually without brown hairs, but often with very small

patches of reddish-brown hairs on each; ventral surfaces and usually lower lateral and lower anterior surfaces of mesepisterna with dark brown hairs; rarely all or almost all thoracic hairs dark brown to black. Metasomal terga with vestiture as in *communis*, but usually with more dark hairs apically on tergum 1 and in the interband zone of tergum 2, tergum 2 with distal pale band rarely wider than one third of apical area medially, tergum 5 often without tufts of long white hairs laterally. Sternal hairs and legs as in *communis*, but often all hairs of fore and middle legs and hind femora and coxae dark brown; inner surfaces of middle and hind basitarsi and hind tibiae with bright red to dark reddish-brown hairs.

Male. Measurements and ratios: N, 20; length, 11-15 mm.; width, 3-5 mm.; wing length, M = 4.33 ± 0.250 mm.; hooks in hamulus, M = 14.90 ± 0.181; flagellar segment 2/segment 1, M = 7.08 ± 0.087.

Structure and color: Color as in *communis*, but spots at bases of mandibles usually only slightly wider than basal depressed punctate triangles and apical margins of terga always piceous. Minimum length of first flagellar segment usually equal to one seventh of maximum length of second segment, often less, occasionally slightly more but never as much as one sixth of second segment; galeae, maxillary palpi and eyes as in *communis*. Punctures of head and thorax as in *communis* except for the following: supraclypeal area usually dulled by dense shagreening and densely punctate; vertex between apices of compound eyes and lateral ocelli with deep round punctures separated by no more and usually less than one puncture width, ground shiny, smooth or very delicately shagreened; mesoscutum with dense small punctures in posteromedian areas as in female; lateral surfaces of mesepisterna with ground usually dulled by fine shagreening. Metasomal terga as in *communis*, but more coarsely punctate in basal area of tergum 1 (punctures separated mostly by one puncture width or less) and in interband zone of tergum 2; apical areas of terga 2 and 3 usually with coarse piliferous punctures at least near the pale pubescent bands; apical areas of terga 1-3 finely shagreened, but moderately shiny, not dulled as in *communis*.

Terminalia as in *communis* with the following differences: gonostyli often slightly shorter and less capitate; spatha usually somewhat blunter laterally; sternum 7 with lateral plate usually equal to half or more of length of sternum from tip of lateral plate to tip of apodeme; sternum 8 usually shallowly emarginate or truncate

apically and with short to moderately long hairs at apex (Figs. 79-81).

Hair: Color and pattern as in female with the following differences: head rarely with dark brown hairs; scutellar and mesoscutal patches of dark hairs usually absent; ventral, lower lateral and lower anterior surfaces of mesepisterna usually without dark hairs, but present in some specimens from southern and eastern parts of the range; apical area of metasomal tergum 1 usually with abundant dark brown hairs; tergum 2 with distal pale band often slightly wider than in female, but never as wide as half of apical area medially as in some specimens of *communis*; interband zone of tergum 2 always with dark hairs in at least lateral third; terga 3 and 4 as in *communis*; tergum 5 never with a complete pale band, usually with lateral tufts of long white hairs; terga 6 and 7 without tufts of white hairs laterally; sterna and legs as in *communis*, but hind coxae and femora and inner surfaces of hind tibiae often with dark reddish-brown hairs in specimens from the southern and eastern parts of the range, occasionally fore and middle femora and tibiae also with dark hairs; inner surfaces of basitarsi usually with yellow to bright red hairs, rarely darker.

Geographical variation. As in *communis*, a great deal of variation in color, as well as in size, occurs in *comptoides*, and there is a general darkening of the hair color towards the east and south. The males bearing dark hairs on the legs and mesepisterna as described above are all from the Gulf States or the Atlantic States south of North Carolina. These characters appear haphazardly and are exhibited by less than 60 percent of the males available for study from these areas. Other characters which also follow this pattern are the dark brown hairs on the scutellum, mesoscutum and vertex of the head and a general darkening of the metasomal vestiture. One small male from Lower Metacumbe Key, Florida, has the hairs of the head, thorax and legs almost all dark brown. The typical banding of the terga is retained in this specimen, although the basal area of tergum 1 has only dark hairs. Three males from Royal Palm State Park, Florida, are somewhat lighter than this, but are generally very dark. From other localities in Florida mixtures of normally pale, intermediate and dark individuals are available.

Females follow this same general distribution in regard to melanism. A series of eleven females from Royal Palm State Park, Florida, exhibit the greatest degree of melanism reached by this

species. Of these eleven females, five have an almost totally dark head and thorax and retain the typical *comptoides* tergal banding, although with only dark hairs basally on tergum 1 and with the basal band of tergum 2 dark brown or mostly so. Two females have the typical coloration of *comptoides,* except for the presence of distinct patches of dark hairs on the mesoscutum and scutellum. The remaining four females exhibit an intergrading series between these. Specimens from other localities in Florida and from the other Atlantic and Gulf States are generally paler than these and most are as pale as the palest specimens from the northwestern part of the range of the species. Three specimens from Liberty, Harris County, and Trinity, Texas, respectively, are almost as dark as the darkest Florida specimen.

As great as the contrast is between the extremes in regard to color, no subspecies of *comptoides* are recognized at this time. A lack of material from the areas involved and, particularly, the almost total lack of series of specimens prohibits adequate description of the obviously highly complicated situation.

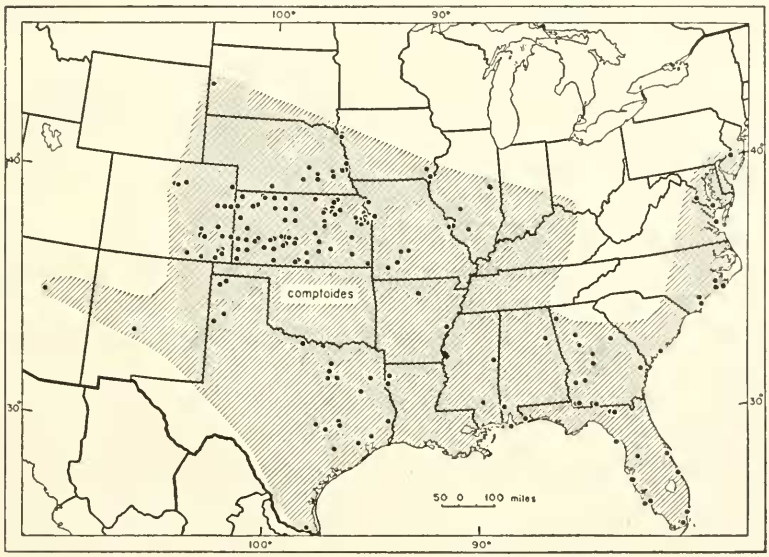

Fig. 13. Map showing the distribution of *M. (Melissodes) comptoides.*

Bionomics. M. comptoides, like *M. communis,* is a highly polylectic species. It has been collected visiting at least fourteen families and thirty-one genera of plants. There appears to be a

rather strong preference for the pollen of *Euphorbia marginata,* at least in the great plains area. In the great plains area and elsewhere the females have often been collected on legumes, especially *Medicago sativa* and *Melilotus alba,* and these plants are probably important as pollen sources. The only composite from which they are known to collect pollen is *Vernonia.*

Type material. Lectotype female of *comptoides,* here designated, from Carlinville, Illinois, August 18, 1897, on *Lythrum alatum,* Charles A. Robertson (collection no. 20449), and male lectoallotype of *comptoides,* here designated, from Carlinville, Illinois, August 1, 1895, on *Lepachys pinnata,* Charles A. Robertson (collection no. 17480) are in the collection of the Illinois Natural History Survey, Urbana. Holotype female of *hitei* from Pueblo, Colorado, August 17, 1907, Hite, is the property of the California Academy of Sciences, but temporarily deposited in the collection of the Citrus Experiment Station, Riverside, California.

Distribution. From northcentral Arizona and eastern Colorado in the west through South Dakota and Illinois to New Jersey in the north and through Texas and the Gulf States to southern Florida in the south (Fig. 13). These bees have been collected from April 17 to October 10, but mainly in July and August over most parts of the range. In addition to the type material, 490 females and 445 males have been examined from the localities listed below. Localities of the type material and those reported in the literature are included in this list.

ALABAMA: Canebreak; Citronelle; Fort Morgan. ARIZONA: Flagstaff. ARKANSAS: Barshed; Spring, Stone Co. COLORADO: Baca Co.; Boulder; Brighton; Burlington; Eads; Flagler; Hoehne; Holly; Kirkwell, Baca Co.; Kit Carson Co.; La Junta; Lamar; Powars, Weld Co.; Rocky Ford; Springfield; Tobe; Two Buttes; Walker Hill, Crowley Co.; Wray. FLORIDA: Bradentown; Cedar Key; Cocoa; Estero; Lacoochee; Miami Beach; Pensacola; Punta Rassa; Royal Palm Hammock; Royal Palm State Park; Sanibel; Suwanee Springs; Swan; Vero Beach. GEORGIA: Atlanta; Bainbridge; Boston; Clyde; Griffin, Lee Co.; Macon; Perry; Rome; Shellman; Spring Creek, Decatur Co.; Thomasville; Warrenton. ILLINOIS: Carlinville; Covington; Urbana. IOWA: Fort Madison; Mount Pleasant; Sargent Bluffs; Sioux City. KANSAS: Baldwin; Barber Co.; Basehor; Blue Rapids; Burdett; Butler Co.; Cherokee Co.; Cheyenne Co.; Clark Co.; Clay Center; Clay Co.; Coffey Co.; Decatur Co.; De Soto; Dickinson Co.; Douglas Co.; Edwards Co.; Ellis Co.; Elmo; Finney

Co.; Ford Co.; Garden City; Graham Co.; Grant Co.; Gray Co.; Hamilton Co.; Harper Co.; Harvey Co.; Hodgeman Co.; Hudson; Jetmore; Johnson Co.; Kanorado; Kearny Co.; Kingman Co.; Lake View; Larned; Lawrence; Leavenworth Co.; Lewis; Manhattan; Marshall Co.; McPherson Co.; Medicine Lodge; Morton Co.; Norton Co.; Oberlin; Osborne Co.; Pawnee Co.; Phillips Co.; Pottawatomie Co.; Randolph; Republic Co.; Rexford; Riley Co.; Rooks Co.; Russell Co.; Stafford Co.; Stanton Co.; Sedgwick Co.; Thomas Co.; Wallace Co.; Wilson Co.; Wichita Co. Louisiana: Keatchie; Shreveport. Maryland: Indian Head; Scotland; Sea Shore. Missouri: Buffalo; Kansas City; Kirkwood; Lebanon (12 miles S. E.); Springfield; St. Joseph; St. Louis; Verona. Mississippi: Hattiesburg; Shuqualak. Nebraska: Cambridge; Chapman; Fairmont; Hastings; Lincoln; Louisville; Malcolm; McCool; Omaha; South Bend. New Jersey: Riverton. New Mexico: Magdalena Mts. North Carolina: Beaufort; Bogue; Lake James; New Bern; Rocky Point; Wilmington. South Carolina: Edesto Beach. South Dakota: Black Hills. Texas: Brazos Co.; College Station; Conlen; Dalhart; Dallas; Dawn; Friona; Harris Co.; Jacksonville; Kirbyville; Lee Co.; Liberty; Longview (6 miles E.); Plano; Raymondsville; Riverside; Rock Island; Rosser; Sterrett; Taylor. Virginia: Camp Peary.

Flower records. *Amphiachyris* sp., *A. dracunculoides, Asclepias incarnatus, Aster* sp., *Blephilia hirsuta, Campanula* sp., *C. americana, Cassia* sp., *C. fasciculata, Cleome serrulata, Cicuta maculata, Cirsium lanceolatum, Diodea teres, Euphorbia* sp., *E. marginata, Gossypium herbaceum, Helenium* sp., *H. tenuifolium, Helianthus* sp., *H. annuus, H. petiolaris, Lepachys pinnata, Lespedeza virginica, Ludwegia alternifolia, Lycopus americanus, Lythrum* sp., *L. alatum, L. lineare, L. salicaria, Medicago sativa, Melilotus alba, Monarda* sp., *M. citriodora, M. fistulosa, M. punctata, Petalostemum purpureum, Prunella vulgaris, Pycnanthemum* sp., *P. flexuosum, P. pilosum, P. virginianum, Ratibida* sp., *Solidago* sp., *S. serotina, Symphoricarpos* sp., *Taraxacum officinale, Teucrium* sp., *T. canadense, Verbena* sp., *V. hastata, V. stricta, Vernonia* sp., *V. fasciculata, V. noveboracensis, Veronica longifolia.*

Melissodes (Melissodes) negligenda Cockerell

Melissodes negligenda Cockerell, 1949, Proc. U. S. Nat. Museum, vol. 98, p. 466.

This species, known only in the female sex, is closely related to *M. comptoides.* Like *comptoides,* it can be distinguished from *communis* and several other members of the subgenus *Melissodes*

by the large deep punctures in the apical areas of metasomal terga 2 and 3, by the densely punctate mesoscutum and by the bright ferruginous hairs of the thorax. These females can be separated from those of *comptoides* by the densely shagreened ground areas of the clypeus and thorax and by the brownish scopal hairs.

Female. Measurements and ratios: N, 1; length, 11-12 mm.; width, 5 mm.; wing length, 3.85 mm.; hooks in hamulus, 16; flagellar segment 1/segment 2, 2.12.

Structure and color: Integument black, distitarsi and flagella beneath rufescent; wings infumate, clear brown, veins dark brown to black; eyes dark grayish-blue. Eyes slightly less than 3 times as long as broad in facial view; maxillary palpal segments in ratio of about 2:2:1.5:1; clypeus with coarse crowded punctures, becoming smaller in apical third, separated by half or less of one puncture width posteriorly, ground opaque, dulled by extremely dense, coarse shagreening; flattened lateral areas of vertex with abundant small punctures separated mostly by one puncture width or slightly less, ground dulled by dense shagreening. Thoracic sculpturing as in *comptoides*, but punctures on mesoscutum and scutellum even more crowded and ground areas everywhere dulled by coarse shagreening. Metasomal sculpturing as in *comptoides*, but punctures in apical areas of terga 2 and 3 separated by 2 to 3 puncture widths and ground areas everywhere moderately shiny, somewhat dulled by moderately coarse, reticular shagreening.

Hair: Head with pale ochraceous to white hairs except abundant black hairs on vertex and on face just mesad of upper halves of compound eyes. Thorax above with bright ferruginous hairs, becoming pale ochraceous to white laterally and on propodeum; ventral, lower lateral and lower anterior surfaces of mesepisterna with dark brown to black hairs. Metasomal hairs and pubescence as in *comptoides*, but white pubescent bands of terga 2 and 3 thin, that on tergum 2 interrupted medially. Legs with dark brown hairs, except scopal hairs medially pale brown.

Type material. Holotype female from Agua Amarilla, Honduras, March 15, A. Carr, in the U. S. National Museum (U. S. N. M. Type No. 58550). Two paratype females from Agua Amarilla, Honduras, March 17, G. Vidales, are also in the U. S. National Museum.

Distribution. Known only from the type material and one additional female collected at Agua Amarilla, December 15, presumably by T. D. A. Cockerell.

Melissodes (Melissodes) maesta, sp. nov.

This species is the first of a series of melanistic species which belong to the *communis* complex in spite of the great color differences. *M. maesta* and *M. morrilli* are two intermediate species between *M. bimaculata* and *M. leprieuri,* the darkest species of North American *Melissodes,* and the other members of the *communis* complex. The males of *maesta,* and of the other melanistic species, have characters of the terminalia and, particularly, the eighth sternum in common with *communis.*

The females of *maesta* can be separated from the foregoing species by the following characters: mesoscutum relatively sparsely punctate; terga 2 and 3 with coarsely punctate apical areas; tergum 2 with the distal pale band broadly interrupted medially (pubescence absent medially, not merely brown). The females of *maesta* can be separated from the other melanistic species of the subgenus by the paler hairs of the thorax and head as described below. The males of *maesta* can be separated from the foregoing species on the same basis as the females, but the mesoscutal punctures are variable and not distinctive in this species. The males can be separated from the other melanistic members of the subgenus by being paler than most of the latter and by differences in tergal punctation as described below.

Female. Measurements and ratios: N, 5; length, 14-15 mm.; width, 5.0-6.5 mm.; wing length, $M = 5.19 \pm 0.495$ mm.; hooks in hamulus, $M = 17.20 \pm 0.374$; flagellar segment 1/segment 2, $M = 1.88 \pm 0.026$.

Structure and color: Integumental color as in *communis* with the following differences: legs dark reddish-brown to black; metasomal terga often very dark reddish-brown with slight violaceous reflections; flagella reddened only on outer half of lower surfaces, mostly dark brown to black; wing membranes dark brown, veins dark reddish-brown to black. With structural characters of *communis* with the following differences: supraclypeal area coarsely punctate; clypeus with rather regular coarse punctures, often without median carina, moderately shiny; metasomal tergum 1 with coarse distinct punctures separated by one puncture width or less in basal three fifths; tergum 2 with small round punctures separated by one puncture width or less in interband zone, these punctures distinct across entire tergum and not much smaller medially than laterally, apical area with abundant distinct punctures equal in diameter to two or three times basal diameter of hairs arising from them and separated from nearest punctures

mostly by one to two puncture widths; tergum 3 with apical area punctate as in tergum 2.

Hair: With characters of vestiture of *communis* with the following differences: vertex of head with more abundant dark brown hairs mixed with pale often extending down along inner margins of compound eyes to clypeus and clypeal hairs all or almost all dark brown. Mesoscutum with large patch of dark brown hairs extending forward to or beyond a transverse line at anterior margins of tegulae and laterally beyond parapsidal lines; tegulae with abundant dark hairs; lateral surfaces of thorax with dark brown hairs, except pale hairs on extreme upper anterior areas of mesepisterna and on posterior halves of lateral surfaces of propodeum. First metasomal tergum with pale ochraceous hairs basally, often with a few dark hairs intermixed, especially on anterior face; tergum 2 with white basal pubescent band and thin, lateral fasciae of white pubescence medially, basal band and distal fasciae not connected laterally by pale hairs or pubescence on dorsum of tergum; tergum 3 with pale band as narrow as or narrower than apical area medially; tergum 4 usually with median diamond-shaped patch of dark brown hairs. Legs with hairs dark brown except reddish-brown to red hairs of inner surfaces of tarsi and hind tibiae, and pale ochraceous scopal hairs.

Male. Measurements and ratios: N, 4; length, 12-14 mm.; width, 4.0-4.5 mm.; wing length, $M = 4.47 \pm 1.610$ mm.; hooks in hamulus, $M = 16.75 \pm 1.493$; flagellar segment 2/segment 1, $M = 4.60 \pm 0.184$.

Structure and color: With integumental color as in *communis* with the following differences: mandibles with small triangular basal spots; clypeus yellow to yellowish-orange; apical areas of metasomal terga opaque, dark reddish-brown, often with slight violaceous reflections; legs reddish-brown to black; wing membranes infumate, brown, veins dark reddish-brown to black. With structural characters of *communis* with the following differences: vertex laterally with large round punctures separated mostly by one puncture width or less, ground smooth and shiny; mesoscutum with coarse punctures, posteromedian area with punctures separated by less than one puncture width to three puncture widths, but rather evenly spaced. Metasomal tergum 1 with basal three fifths with coarse round punctures separated mostly by one puncture width; basal area of tergum 2 with distinct punctures across entire tergum, punctures separated by one to two puncture widths; apical areas of terga 2-4 with small round punctures equal to two or

three times basal width of hairs arising from them and separated from nearest punctures mostly by one puncture width or slightly more; metasomal terga with ground shiny to moderately shiny, finely shagreened.

Characters of genitalia and hidden sterna essentially as in *M. communis*.

Hair: Vestiture as in *communis* with the following differences: vertex of head with dark brown hairs; mesoscutum and scutellum with large patches of dark brown hairs; pale hairs of head, thorax and metasoma pale ochraceous to white; lateral surfaces of mesepisterna and metepisterna and anterolateral surfaces of propodeum often with brown hairs (as in holotype); metasomal tergum 1 with abundant dark brown appressed to suberect hairs apically; tergum 2 with distal pale band usually broadly interrupted medially, resulting in lateral fasciae which are exceedingly thin and connected with basal pale band by pale pubescence only at extreme sides of tergum; tergum 3 with pale pubescence diffuse, not completely hiding surface, pale band medially as wide as or narrower than apical area; tergum 4 with pale band often interrupted medially by brown pubescence, extremely narrow; tergum 5 with or without narrow, pale, medially interrupted band. Legs with pale ochraceous hairs except rufescent hairs of distitarsi and inner surfaces of basitarsi, and often with brown hairs on inner surfaces of femora and tibiae.

Type material. Holotype male and two paratype males from Kerrville, Texas, June 1, 1906, on *Helenium* sp., F. C. Pratt, and the allotype female from the Davis Mountains, Jeff Davis County, Texas, May 6, 1907, on *Monarda citriodora*, F. C. Bishopp. Three paratype females from the Davis Mts., July 10, 1907, H. A. Scullen; one paratype female from San Antonio, Texas, June, 1942, E. S. Ross. The holotype and allotype are in the collection of the U. S. National Museum. Paratypes are in the collections of the California Academy of Sciences, the Snow Entomological Museum at the University of Kansas, the Oregon State College of Agriculture and in the author's collection.

Melissodes (Melissodes) labiatarum Cockerell

Melissodes labiatarum Cockerell, 1896, Ann. Mag. Nat. Hist., ser. 6, vol. 18, p. 291.

This species, known only in the male sex, is extremely close to *M. maesta*. It can be distinguished from the males of *maesta, bimaculata* and *leprieuri* by the less abundant punctures in the apical

areas of terga 2-4 and by the impunctate triangular area on the upper part of the declivous face of the propodeum which in *labiatarum* is dulled by dense shagreening.

Male. Measurements and ratios: N, 4; length, 12-13 mm.; width, 4.0-4.5 mm.; wing length, M = 4.31 ± 0.342 mm.; hooks in hamulus, M = 15.00 ± 0.435; flagellar segment 2/segment 1, (N, 3) M = 4.58 ± 0.247.

Structure and color: Black; clypeus, labrum (except extreme apical margin) and usually small triangular spots at bases of mandibles yellow; tarsi rufescent, tibiae and femora dark reddish-brown; metasomal terga black with slight violaceous reflections; sterna dark reddish-brown; flagellum dark brown below and dark red above, except first segment which is wholly brown; wings infumate, membranes yellowish-brown, veins dark reddish-brown to black. Clypeus coarsely punctate, ground dulled by shagreening; maxillary palpal segments in ratio of about 2:2:1.5:1; minimum length of first flagellar segment equal to one fourth of maximum length of second segment or slightly less. Mesoscutum with deep round punctures separated by half of one puncture width or less anteriorly and laterally and by one to three puncture widths in posteromedian area; scutellum with smaller more crowded punctures; ground areas of mesoscutum shiny, not or scarcely shagreened; metanotum with small crowded punctures, ground dulled by dense shagreening; lateral surfaces of mesepisterna with coarse punctures about equal in size to median mesoscutal punctures, ground areas dulled by delicate shagreening; propodeum coarsely punctate and dulled by dense shagreening, upper impunctate triangular area of declivous face opaque, densely shagreened. Sculpturing of metasoma as in *maesta* except punctures of apical areas of terga 2-4 larger and less abundant; apical area of tergum 2 with punctures separated mostly by two puncture widths basally, becoming more widely separated apically, with narrow impunctate apical margin equal to one third of apical area medially.

Genitalia much as in *communis*. Sternum 7 with truncate apodemes. Sternum 8 with short sparse hairs apically; median longitudinal carina not reaching apical margin of sternum which is deeply emarginate medially at apex (Figs. 82-84).

Hair: Vestiture as in *maesta* with the following differences: occipital and genal areas of head with dark brown hairs, but vertex and face without dark hairs; sides of thorax usually with abundant brown hairs; pronotum usually with hairs all or almost all dark brown; mesoscutum with large posteromedian patch of dark brown

to black hairs, anteriorly and laterally with yellow or ochraceous hairs; propodeal hairs all dark; first metasomal tergum with dark hairs on anterior face, long mixed pale and dark hairs in basal half of dorsal face; terga 2-6 with very little pale pubescence laterally and no complete pale bands; sternal hairs mostly dark brown, pale laterally.

Remarks. The series of eight males from Paso de Telayo are remarkable in showing a great deal of variation in the color of the vestiture. These range from specimens as pale as *maesta* and hardly distinguishable from the latter on the basis of color to the dark color of the holotype as described above. The pale specimens are perhaps a new species, but are not described here, since the full range of color variation and punctation of *labiatarum* cannot be estimated from the few specimens available. If the pale specimens from Paso de Telayo are conspecific with *labiatarum,* it is likely that *maesta* is no more than a northern race of this species. Much more collecting needs to be done in the area along the eastern coast of Mexico to clarify this problem. Virtually no specimens of *Melissodes* are available from the coastal area between Veracruz and Brownsville, Texas. It is also probable that *M. morrilli,* known only in the female sex, from the southern plateau area of Mexico represents the female of *labiatarum.* However, the less distinct punctation of the apical areas of the terga of *morrilli* suggests that it is a distinct species. Until sexes can be allied by field observations, or at least by collecting them in the same region, it is best to consider these as being distinct species.

Type material. Holotype male from San Rafael, Veracruz, Mexico, March 11, 1895, C. H. T. Townsend, is in the U. S. National Museum (U. S. N. M. Type No. 3356). Five male paratypes from Paso de Telayo, Jicoltepec, Veracruz, April 7 and 8, C. H. T. Townsend, are also in the U. S. National Museum.

Distribution. Known only from the type material plus three additional males, provisionally placed here, which were collected by Townsend at Paso de Telayo, Veracruz, presumably at the same time as the paratypes.

Melissodes (Melissodes) morrilli Cockerell.

Melissodes morrilli Cockerell, 1918, Trans. Amer. Ent. Soc., vol. 44, p. 29 (*bimaculata* subsp.).

This species is closely allied to *M. communis* from which it differs chiefly by the dark hairs of the head and thorax. It superficially resembles *M. bimaculata* from which it can be distinguished by the

more abundant punctures on the mesoscutum, by the less distinct punctures of the apical areas of the terga and by the red hairs of the inner surfaces of the hind basitarsi. It is superficially similar to *M. morosa* Cresson from which it is distinguished by the dark hairs of the face, the white metasomal pubescence and the shiny galeae.

Females. Measurements and ratios: N, 15; length, 13-15 mm.; width, 4.5-5.0 mm.; wing length, $M = 4.74 \pm 0.051$ mm.; hooks in hamulus, $M = 16.47 \pm 0.123$; flagellar segment 1/segment 2, $M = 2.02 \pm 0.103$.

Structure and color: Black; distitarsi and flagella on outer half of lower surfaces rufescent; mandibles dark red in apical halves except tips, often with golden maculae in apical median halves or less; eyes grayish-black to dark green; wing membranes infumate, dark brown, veins dark reddish-brown to black. With structural characters of *communis* with the following differences: punctures of mesoscutum usually more crowded, separated by one to two puncture widths in posteromedian area, becoming smaller and more crowded posteriorly; propodeum with ground areas opaque, dulled by dense shagreening; first metasomal tergum with punctures of basal three fifths more distinct, separated mostly by less than one puncture width, ground dulled by dense shagreening; tergum 2 with punctures of interband zone slightly more distinct, especially laterally; apical areas of terga 2 and 3 with small indistinct shallow punctures separated by 2 to 5 puncture widths, virtually impunctate, ground dulled by fine dense shagreening.

Hair: On head and thorax black or dark brown, occasionally genal areas immediately laterad of upper halves of eyes with a few white or ochraceous hairs. First metasomal tergum with black or dark brown hairs; tergum 2 with black or dark brown hairs and pubescence except often with short, thin, lateral fasciae of white pubescence medially (remnants of the distal pale band of other species of this subgenus); tergum 3 usually with a thin median band of white pubescence, often interrupted medially, occasionally entirely dark brown; tergum 4 usually with a broad apical band of white pubescence interrupted medially by a small rectangle of simple brown hairs, pale band narrower medially than apical area of tergum 3; terga 5 and 6 with dark brown to black hairs; sternal hairs dark brown to black. Fore and middle legs, hind coxae and femora and basitibial plates with dark brown to black hairs, except for rufescent hairs of inner surfaces of hind tarsi; scopal

hairs pale ochraceous to yellow; hairs of inner surfaces of hind basitarsi usually yellowish-red, occasionally reddish-brown and hairs of inner surfaces of hind tibiae yellowish-red to red.

Remarks. As stated above, it is possible that these are the females of *labiatarum*, but males have not been collected with the females. Furthermore, *labiatarum* males appear to be closely related to those of *maesta,* so closely that these two may be geographical races of one species. The females of *morrilli* are quite distinct from those of *maesta* on the basis of sculptural characters, as well as color, and this provides indirect evidence that *morrilli* and *labiatarum* are distinct species.

Type material. Holotype female from Tlahualilo, Durango, Mexico, September 2, 1904, A. W. Morrill, on squash, is in the U. S. National Musuem (U. S. N. M. Type No. 22918). One paratype from the vicinity of México (city), Mexico, July, 1897, O. W. Barrett (C. F. Baker collection), is also in the U. S. National Museum.

Distribution. Lower plateau area of Mexico from Tlahualilo, Durango, in the north to Atlixco, Puebla, in the south. Since very little new material has become available in addition to the type material, data for these are given in full below. Fifteen additional females examined are as follows:

Durango: Durango, 1 female, August 14, 1947, W. Gertsch; Durango, 1 female, August 14, 1947, C. D. Michener; Nombre de Dios, 1 female, on *Eysenhardtia polystachya,* August 5, 1951, P. D. Hurd. Distrito Federal: 1 female, L. Conradt; Xochimilco, 1 female, September 1, 1947, H. E. Milliron; 8 females, vicinity of México (city), July, 1897, O. W. Barrett. Puebla: Atlixco (7 miles S.), 1 female, July 13, 1953, Univ. of Kansas Mexican Expedition.

Melissodes (Melissodes) bimaculata (Lepeletier).

This is a highly variable melanistic species divisible into two subspecies. The females are easily recognized by the dark hairs of the head, thorax and metasoma, except the two lateral maculae of white pubescence usually present on tergum 4 and the usually white scopal hairs, and by the black hairs of the inner surfaces of the hind tibiae and basitarsi. The females are easily separated from the other melanistic species of the subgenus *Melissodes* by the distinctly punctate apical areas of terga 2 and 3, the sparse pubescence on tergum 2 and the sparse punctures on the mesoscutum. The males are much more variable than the females in

regard to the color of the vestiture. The punctate apical areas of terga 2 to 4, the length of the first flagellar segment, the punctation of the mesoscutum and the sparse metasomal pubescence will together separate the males of *bimaculata* from those of the other melanistic species of this subgenus.

Female. Measurements and ratios: N, 20; length, 12-15 mm.; width, 5-6 mm.; wing length, $M = 4.87 \pm 0.349$ mm.; hooks in hamulus, $M = 17.90 \pm 0.376$; flagellar segment 1/2, $M = 2.03 \pm 0.023$.

Structure and color: Black; distitarsi often and basitarsi occasionally dark brownish-red; eyes black, brownish when faded; flagella all black or somewhat reddish on lateroventral surfaces; wing membranes deeply infumate, brown, veins black to dark brown; tegulae black; tibial spurs dark brown to black. Clypeus coarsely punctate, punctures large, deep, irregular, elongate laterally and separated mostly by half of one puncture width or less, usually without median carina or boss, ground areas shiny to moderately shiny, with delicate striations; supraclypeal area coarsely punctate laterally, sparsely punctate medially, ground shiny to moderately shiny with delicate shagreening; flattened areas of vertex extending mesad and somewhat posterior from apices of compound eyes coarsely and densely punctate, punctures mostly separated by less than one puncture width, ground moderately shiny, delicately shagreened. Mesoscutum with punctures in large posteromedian area sparse, separated by one half to four puncture widths, round and deep, ground shiny, delicately or not at all shagreened; scutellum with crowded punctures separated mostly by one half to one puncture width, ground delicately shagreened, punctures of about same size as on adjacent area of mesoscutum; lateral faces of mesepisterna with abundant punctures separated mostly by half of one puncture width and rarely by more than one puncture width, distinctly smaller than those of posteromedian area of mesoscutum; propodeum as in *communis*, but upper impunctate triangle of declivous face moderately shiny, with delicate shagreening. Basal three fifths of first metasomal tergum with distinct round punctures separated mostly by one puncture width or less, ground shagreened, but moderately shiny; terga 2 and 3 punctate everywhere, punctures separated by one half to three puncture widths, but mostly by about one puncture width; tergum 4 similarly punctate medially and basally, but punctures more crowded beneath lateral pubescent fasciae.

Hair: Metasomal tergum 2 with sparse pubescence, with abundant appressed or suberect simple black hairs, plumose pubescent band at extreme base and often with very few black plumose hairs in a thin median strip on each side (remnants of distal pale band of other species); tergum 3 with sparse dark brown to black pubescence; tergum 4 with a distinct apical pubescent band, white laterally and brown medially, often interrupted medially by triangular area of simple black hairs. Characters involving color of vestiture are described more fully below for each subspecies.

Male. Measurements and ratios: N, 20; length, 10-15 mm.; width, 3.5-5.5 mm.; wing length, M = 4.46 ± 0.217 mm.; hooks in hamulus, M = 15.65 ± 0.335; flagellar segment 2/segment 1, M = 4.69 ± 0.108.

Structure and color: Black; legs and sterna often dark reddish-brown; clypeus yellow; bases of mandibles usually with large yellow triangular spots, occasionally much reduced and rarely absent; labrum white, sometimes with narrow brown apical margin; flagella reddish to yellow below, first segment entirely and remaining segments above dark brown to black; wing membranes infumate, but less so than in females, veins dark reddish-brown to black; tegulae dark reddish-brown to black; tibial spurs yellow to black; eyes green to black. Eyes more than one third as wide as long in facial view, strongly converging below; minimum length of first flagellar segment equal to one fifth or more of maximum length of second segment; maxillary palpal segments as in female. Punctation as in female, but mesoscutal punctures often somewhat more crowded and basal four fifths of first metasomal tergum coarsely punctate.

Genitalia and hidden sterna much as in *communis*; sternum 7 with larger lateral plates and shorter apodemes than in *communis*; sternum 8 with larger lateral apodemes and more constricted medially than in *communis* (Figs. 85-87).

Hair: Hairs generally sparse as in female; metasomal terga 2 and 3 with very sparse pubescence as in female. Color characters involving vestiture are described below for each subspecies.

Bionomics. The only published record of the nesting habits of this species is a short note by W. A. Ashmead (1894). Ashmead found a female entering a burrow directly beneath a small flat stone in an open field. The burrow extended under the stone a short distance, then extended vertically into the soil and terminated in a cell constructed of clay at a depth of eight inches.

M. bimaculata is one of the most polylectic species of the genus *Melissodes*. It has been collected on flowers of about 65 families of plants and is known to collect pollen from about half of these. It follows that this species is not particularly dependent on composites as pollen sources. On the contrary, it seemingly prefers plants of the families Labiatae and Leguminosae, but is known to collect pollen from such unrelated families as Malvaceae, Convolvulaceae, Cucurbitaceae and Onagraceae. The list of plants given below on which this species has been collected is, accordingly, impressive for its length and for the variety of plants represented.

Geographical variation. *M. bimaculata* is divisible into two rather distinct subspecies on the basis of color. *M. bimaculata bimaculata* occupies most of the eastern United States, whereas the dark subspecies, *nulla,* occupies the tip of the Florida peninsula. The subspecies *bimaculata* is known from northern Florida, and darker specimens of this subspecies from Georgia and the Gulf States to Texas provide evidence of gene flow from the dark subspecies of southern Florida. Cockerell (1905) described a darker variety from Texas (*melanosoma*). These males are merely variants which appear haphazardly throughout the range of *bimaculata s. str.* and do not represent a distinct southwestern race. In the same paper Cockerell published a short key to three other varieties of *bimaculata* based on hair color and the size of the yellow mandibular spots of the males. As in the case of *melanosoma,* these are variants which appear throughout the range of *bimaculata* and Cockerell seemingly recognized this, since he did not honor these three with names.

The dark subspecies, *nulla,* superficially appears to represent intergrades between *bimaculata* and the generally darker species, *leprieuri,* from Cuba. However, the presence of a complete pubescent band on tergum 2 (albeit usually dark in color) in *leprieuri* and the difference in punctation of the terga between the two forms provide evidence for considering them as distinct species. Furthermore, *nulla* exhibits the maximum size for *bimaculata,* whereas *leprieuri* is on the average as small as the smaller specimens of *bimaculata.*

Melissodes (Melissodes) bimaculata bimaculata (Lepeletier).

Macrocera bimaculata Lepeletier, 1825, *in* Latreille, Encyclopédie méthodique. Histoire naturelle, vol. 10, p. 527.
Macrocera binotata Say, 1837, Boston Jour. Nat. Hist., vol. 1, p. 404.
Macrocera nigra Lepeletier, 1841, Histoire naturelle des Insectes, Hyménoptères, vol. 2, p. 112.

Melissodes nigra, Smith, 1854, Catalogue of Hymenopterous Insects in the Collection of the British Museum, part 2, p. 310.

Melissodes bimaculata, Cresson, 1879, Trans. Amer. Ent. Soc., vol. 7, p. 225; Ashmead, 1894, Psyche, vol. 7, p. 25; Smith, 1896, Rept. Ent. Dept. New Jersey Agric. Coll. Exp. Stat., fig. 21; Bridwell, 1899, Trans. Kansas Acad. Sci., vol. 16, p. 211; Cockerell, 1899, Ent. News, vol. 10, p. 3; Harris and Kuehs, 1902, Univ. Kansas Sci. Bull., vol. 1, p. 36; Banks, 1902, Jour. New York Ent. Soc., vol. 10, p. 209; Cockerell, 1903, Ann. Mag. Nat. Hist., ser. 7, vol. 12, p. 449; Robertson, 1905, Trans. Amer. Ent. Soc., vol. 31, p. 367; Cockerell, 1905, Can. Ent., vol. 37, p. 267; 1906, Trans. Amer. Ent. Soc., vol. 32, p. 81; Tucker, 1909, Trans. Kansas Acad. Sci., vol. 22, p. 281; Smith, 1910, Ann. Rept. New Jersey State Museum, 1909, p. 693; Graenicher, 1911, Bull. Publ. Mus. Milwaukee, vol. 1, p. 247; Viereck, 1916, Bull. Connecticut Geol. Nat. Hist. Surv., vol. 5, no. 22, p. 733; Washburn, 1919, Seventeenth Report of the State Entomologist of Minnesota—1918, p. 230; Folsom, 1922, Ann. Ent. Soc. Amer., vol. 15, p. 183; Rau, 1922, Trans. Acad. Sci. St. Louis, vol. 24, p. 34; Leonard, 1926, Mem. Cornell Univ. Agric. Exp. Stat., no. 101, p. 1026; Robertson, 1928, Flowers and Insects, p. 8; Pearson, 1933, Ecol. Monogr., vol. 3, p. 380; Cockerell, 1935, Amer. Mus. Nov., no. 766, p. 3; Graenicher, 1935, Ann. Ent. Soc. Amer., vol. 28, p. 304; Brimley, 1938, Insects of North Carolina, p. 462; Fattig, 1945, Emory Univ. Mus. Bull., no. 3, p. 5; Michener, 1947, Amer. Mid. Nat., vol. 38, p. 453; Stevens, 1951, North Dakota Agric. Exp. Stat. Bull., vol. 14, p. 29.

Melissodes binotata, Tucker, 1909, Trans. Kansas Acad. Sci., vol. 22, p. 281.

Melissodes melanosoma Cockerell, 1905, Can. Ent., vol. 37, p. 266 (new synonymy).

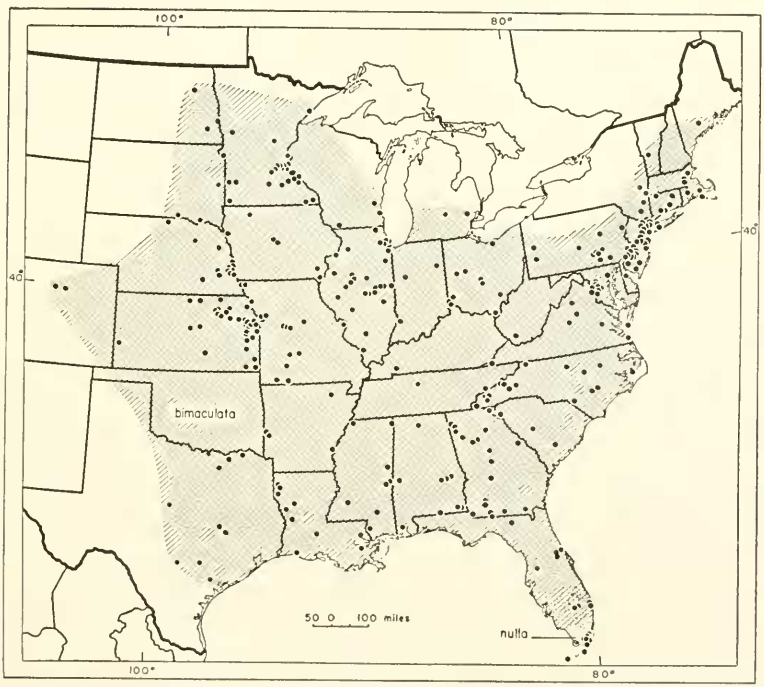

FIG. 14. Map showing the distribution of *M. (Melissodes) bimaculata*. The overlapping type of shading indicates the zone of intergradation between the two subspecies.

This subspecies is on the average slightly smaller and paler than *nulla*. The females of *bimaculata* can be separated from those of *nulla* by almost always having the white lateral pubescent fasciae on tergum 4 and by the white scopal hairs. The males of *bimaculata* can be distinguished from those of *nulla* by the usual presence of white hairs laterally on the terga, the white hairs of the outer surfaces of the hind tibiae and basitarsi and by the usual presence of some white hairs on the mesoscutum and often on the sides of the thorax.

Female. Hairs and pubescence usually all black or dark brown except as follows: tergum 4 with distinct apical lateral fasciae of silvery-white pubescence; in palest specimens face with a few white hairs just above and laterad of antennal fossae; scopal hairs white, occasionally a few brown hairs at apices of hind basitarsi and around basitibial plates; inner surfaces of fore and middle tarsi and hind distitarsi often with very dark reddish-brown hairs; inner surfaces of hind basitarsi and tibiae usually with black or dark brown hairs, rarely these hairs rufescent and then probably due to fading with age.

Male. Very variable in color. Head with white hairs except black hairs on vertex and black hairs mixed with white on genal areas. Thoracic hairs usually all black, but often with sparse white hairs anteriorly and laterally on mesoscutum and on posterior margin of scutellum, and mixed black and white hairs on lateral surfaces of mesepisterna in pale specimens; tegulae with black hairs; propodeum always with black hairs except several long white hairs dorsally. Metasomal terga usually with black hairs and pubescence except short fasciae of white pubescence and a few long white hairs laterally on terga 2 to 5; occasionally dark specimens without metasomal white hairs, occasionally pale specimens with a complete white pubescent band on tergum 3 and rarely on tergum 4 as well; sternal hairs black to dark brown. Legs variable, usually outer surfaces of tibiae and basitarsi with white hairs and remaining surfaces with black or brown hairs; inner surfaces of fore, middle and hind basitarsi usually with dark reddish-brown hairs, occasionally red or yellow on these and on inner surfaces of hind tibiae.

Type material. Female holotype of *bimaculata* lost or destroyed. Male holotype of *nigra* is in the Saussure collection in the Museum of Natural History, Geneva, Switzerland. The type material of *binotata* from Indiana has been destroyed. The male holotype of *melanosoma* from Fedor, Texas, May 26, 1904, G. Birkmann, is the

property of the California Academy of Sciences, but is temporarily deposited in the collection of the Citrus Experiment Station, Riverside, California.

Distribution. From North Dakota south through eastern Colorado to northeastern New Mexico, east to Maine in the north and to northern Florida in the south (Fig. 14). This subspecies has been collected from May 9 to October 27. Localities reported in the literature are listed below together with localities of 528 females and 838 males which have been examined.

Alabama: Coatopa; Cowarts; Decatur; Dothan; Florala; La Place; Mobile; Mt. Meigs; Tuskegee. Arkansas: Lawrence Co.; Polk Co.; Rich Mt.; White River. Colorado: Boulder; Brighton. Connecticut: Colebrook; East Haddum; New Haven; Storrs; Westville. Florida: Indian River; Lacoochee; Orange City; Sanford; Suwanee Springs. Georgia: Armuchee; Atlanta; Billy's Island, Okefenokee Swamp; Dallas; DeWitt; Harlem; Macon; Mitchell Co.; Monticello; Rabun Co.; Rome Spring Creek, Decatur Co.; Stone Mt.; Summerville; Thomasville; Thomsons Mills; Unadilla; Valdosta. Illinois: Bath; Bement; Bloomington; Carlinville; Champagne; Charleston; Chicago; Danville; Decatur; Downers Grove; Grand Tower; Harristown; Homer Park; Kankakee; McHenry; Manito; Matteson; Meredosia; Moline; Oak Park; Pekin; Peoria; Roseville; Tampico; Urbana; West Pullman; White Heath; Willow Springs. Indiana: Lafayette; Vincennes; Wells Co. Iowa: Ames; Fort Madison; Griffin; Mt. Pleasant; Sioux City; Spencer. Kansas: Allen Co.; Atchison Co.; Baldwin, Douglas Co.; Cherokee Co.; Clearwater, Riley Co.; Crawford Co.; Deep Creek, Riley Co.; DeSoto, Johnson Co.; Douglas Co.; Ellsworth Co.; Eudora, Douglas Co.; Franklin Co.; Garnett, Anderson Co.; Hamilton Co.; Jewell Co.; Labette Co.; Lake View, Douglas Co.; Lawrence, Douglas Co.; Louisburg, Miami Co.; Manhattan, Riley Co.; Marysville, Marshall Co.; Olathe, Johnson Co.; Onaga, Pottawatomie Co.; Ottawa, Franklin Co.; Parker, Linn Co.; Pottawatomie Co.; Republic Co.; Riley Co.; Saline Co.; Sunflower, Douglas Co.; Topeka, Shawnee Co.; Wabaunsee Co.; Wathena, Doniphan Co.; Wichita, Sedgwick Co. Kentucky: Cadiz. Louisiana: Covington; Creole; Forbing; Greenwell Springs; Keatchie; Leesville; Many; Mound; Natchitoches; New Orleans; Opelousas; Shreveport. Maine: Winthrop. Maryland: Baltimore; Cabin John; Glen Echo; Montgomery Co. Massachusetts: Framingham; Holliston; Lexington; Marion; Woods Hole. Michigan: East Lansing; Pontiac. Minnesota: Big Stone Co.;

Caledonia; Carver Co.; Chisago Co.; Excelsior; Faribault; Harmony; Hennepin Co.; Lake City; Lincoln Co.; Luverne; Lyon Co.; Mille Lacs; Minneapolis; North Branch; Otter Tail Co.; Powder Plant Woods, Ramsey Co.; Red Rock; Red Wing; Stanton; St. Anthony Park; St. Paul; St. Peter; Sucker Lake; Washington Co. MISSISSIPPI: DeSoto Co.; Hattiesburg; Iuka; McNeill; Meridian; Peetsville; Shuqualak; Toomsuba. MISSOURI: Atchison Co.; Atherton; Buffalo; Columbia; Hollister; Jackson Co.; Kansas City; Lebanon; Roaring River State Park; Rockport; Sedalia; Smithton; Pettis Co.; Springfield; St. Louis. NEBRASKA: Carns; Fairmont; Fontinelle Forest (near Omaha); Lincoln; Louisville; Malcolm; Meadow; Neligh; Omaha; South Bend; Union; Weeping Water; Westpoint. NEW JERSEY: Bergen Co.; College Farm; Eatontown; Englewood Cliffs; Haddon Heights; Jamesburg; Monmouth Co.; Manumuskin; Merchantville; Moorestown; New Brunswick; Passaic; Passaic Junction; Paterson; Princeton; Ramsey; Rancocas Park; Riverton; Salem Co.; Snake Hill; South Lakewood; South Orange; Springfield; Westville; Weymouth. NEW MEXICO: Magdalena Mts. NEW YORK: Copake Falls; Huntington; New Baltimore; New Windsor; New York City; Nyack; Pearl River; Pelham; Poughkeepsie; Scarsdale; Watchoque; Wyandauch. NORTH CAROLINA: Black Mts. (valley of); Bryson City; Burlington; Clinton; Faison; Hyde Co.; Judson; Lake James; Madison Co.; Marion; Mars Hill; Maxton; Murphy; Nanthala Gorge; New River; Raleigh; Rocky Mt. NORTH DAKOTA: Fargo; Lakota; Sheldon. OHIO: Athens; Butler Co.; Columbus; Elyria; Franklin Co.; Harrison; Lawrence Co.; Logan Co.; Shelby Co. PENNSYLVANIA: Annville; Belleville; Bloomsburg; Bird-in-hand; Bristol; Camphill; Chester; Delaware Watergap; Harrisburg; Highspire; Inglewood; Lemoyne; Philadelphia; Pittsburgh; Prospect; Torresdale; York. RHODE ISLAND: Providence. SOUTH CAROLINA: Batesburg; Clemson College; St. George. SOUTH DAKOTA: Brookings; Fairfax; Springfield. TENNESSEE: Gatlinburg; Nashville; "E. Tenn." TEXAS: Bexar Co.; Bonham; Brazos Co.; Brownwood; Calvert; McKinney; Palmetto State Park, Gonzales Co.; Paris; Victoria. VERMONT: Rutland. VIRGINIA: Alexandria Co.; Barcraft; Cape Charles; Charlottsville; Clifton; Falls Church; Glencarlyn; Great Falls; Nelson Co.; Pennington Gap; Princess Anne Co.; Scott's Run; Seven Pines; Shenandoah. WEST VIRGINIA: Baileysville. WISCONSIN: Maiden Rock; Milwaukee; Prescott; Shullsburg; Washington Co.

Flower records. Abutilon theophrasti, Agastache nepetoides, Althaea rosea, Arctium minus, Asclepias sp., *A. tuberosus, A. verticil-*

lata, Asparagus sp., *Aster* sp., *A. novae-angliae, A. paniculata, Astragulus canadensis, Baptisia tinctoria, Bidens aristosa, Blephilia hirsuta, Brauneria purpurea, Cacalia reniformis, Campanula* sp., *C. americana, C. rotundifolia, Cassia fasciculata, Cephalanthus occidentalis, Cicuta maculata, Cirsium* sp., *C. lanceolatum, Convolvulus* sp., *C. sepium, Cuphea petiolata, Cucurbita* sp., *C. pepo, Dalea onobrychis, Desmodium* sp., *D. bracteosum, D. canadense, D. dillenii, D. paniculatum, Dianthera americana, Dipsacus sylvestris, Echinocystis lobata, Eupatorium coelestinum, Gaura biennis, Gerardia grandiflora, Gladiolus* sp., *Gossypium herbaceum, Grindelia* sp., *Helenium* sp., *H. autumnale, Helianthus* sp., *H. annuus, H. divaricatus, H. grosse-serratus, H. tuberosus, Hibiscus* sp., *H. lasiocarpus, H. militaris, Impatiens biflora, Ipomoea* sp., *I. pandurata, I. purpurea, Jacquemontia temnifolia, Lepachys pinnata, Lespedeza procumbens, Lobelia* sp., *L. leptostachys, L. siphillitica, Lythrum* sp., *L. alatum, Malva rotundifolia, M. sylvestris, Medicago sativa, Melilotus alba, M. officinale, Mentha* sp., *Monarda fistulosa, M. mollis, M. punctata, Nepeta cataria, Oenothera biennis, Oxalis stricta, Petalostemum* sp., *P. purpureum, Petunia* sp., *Physostegia virginiana, Platycodon grandiflorum, Polygonum pennsylvanicum, Prunella vulgaris, Pycnanthemum* sp., *P. flexuosum, Ratibida* sp., *Rhus copallina, Rudbeckia triloba, Sagittaria* sp., *Scrophularia marilandica, Scutellaria lateriflora, Seymeria macrophylla, Sicyos angulatus, Silphium laciniatum, S. perfoliatum, Siscanna* sp., *Solidago* sp., *Stachys palustris, Strophostylis* sp., *Symphoricarpos* sp., *S. occidentalis, S. orbiculata, Teucrium canadense, Trifolium pratense, Verbena* sp., *V. hastata, V. stricta, V. urticaefolia, Vernonia* sp., *V. fasciculata, V. baldwini interior, V. spicata, Veronica virginica, Vitex agnus-castus.*

Melissodes (Melissodes) bimaculata nulla, subsp. nov.

This subspecies is on the average slightly larger and darker than *bimaculata s. str.,* and can be distinguished from the latter on the basis of the characters listed in the diagnosis of *bimaculata.* In both sexes of *nulla,* if the hairs of the outer surfaces of the hind basitarsi and tibiae are partially pale in color, they are usually ochraceous to bright orange, rather than white.

Female. In typical dark specimens vestiture, including scopal hairs, entirely dark brown or black; in somewhat paler specimens a few yellowish scopal hairs appear near apices of hind tibiae and these become more abundant in yet paler forms, yellowish scopal

hairs of basitarsi first appear basally and spread towards apices, rarely with more than median two thirds of scopal hairs pale, pale scopal hairs, when present, ochraceous to bright orange; in palest specimens lateral fasciae of white pubescence appear on fourth tergum and become progressively larger until each equals one third of total width of tergum in palest specimens.

Male. In typical dark specimens vestiture, including hairs on outer surfaces of legs, black or dark brown, except white hairs on face above clypeus and below ocelli; in somewhat paler specimens several yellowish hairs appear on outer surfaces of hind tibiae near apices and progressively spread basad in still paler individuals, yellowish hairs appear first basally on outer surfaces of hind basitarsi and spread distally in still paler individuals, usually with two thirds or less of hairs of outer surfaces of hind basitarsi and tibiae pale and these usually ochraceous to orange, rarely white as in *bimaculata s. str.;* in palest individual small lateral tufts of white hairs appear on metasomal terga, especially on tergum 3, and a few white hairs anteriorly and laterally on mesoscutum.

Remarks. From the above description, one can perceive that a few specimens of both sexes are practically indistinguishable from the typical subspecies. This is especially true of the males. More than 90 percent of the females and more than 75 percent of the males are recognizable, however, on the basis of the characters listed in the diagnoses of these subspecies. The males, as in most species of *Melissodes,* are more variable than the females. Series of specimens from localities listed below as in the zone of intergradation show the entire range of color from one extreme to the other, and less than the above percentages are identifiable as either *bimaculata* or *nulla.* On the average these specimens are darker than *bimaculata s. str.,* and they probably mark only the southern edge of the zone of intergradation. More specimens are needed from the northern two thirds of the Florida peninsula in order that this zone be satisfactorily described.

Type material. Holotype male from Royal Palm Hammock, Florida, June 22, 1951, Roger Price, L. D. and R. H. Beamer and S. L. Wood. Allotype female with the same data, but collected from flowers of *Lythrum lineare.* Paratypes from Florida include 22 females and 16 males as follows: Homestead: 1 female, April 2, 1952, J. R. McGillis. Lower Metacumba Key: 1 female, September 4, 1931, Bradley and Knorr. Paradise Key, Dade Co.: 1 female, May 16, 1937, Richard Dow; 1 male, April 1, 1928, D. M.

Bates; 1 female, C. A. Mosier; 1 male, April 6, 2 males, April 12, 1951, H. and M. Townes; 1 female, March 29, 1952, G. S. Walley; 1 female and 2 males, March 22, 1 female and 5 males, March 23, 1954, K. V. Krombein. Royal Palm Hammock: 2 females, June 22, 1951, L. D. and R. H. Beamer, S. L. Wood and Roger Price. Royal Palm State Park: 2 females, March 8, 3 females, March 9-10, 1 male, March 12, 1 female, March 16, F. M. Jones; 3 females, April 12-18; 1 male March 17, 1925, W. S. Blatchley. Trail City: 1 male, April 7, 1952, J. R. Vockeroth. The holotype and allotype are in the Snow Entomological Museum at the University of Kansas. Paratypes are in the collections of the U. S. National Museum, the American Museum of Natural History, the Snow Entomological Museum, the Museum of Comparative Zoology, Cornell University, the North Carolina State College of Agriculture and Engineering, the Canadian National Collection, and in the author's collection.

Distribution. Tip of the Florida peninsula north to Palm Beach and Lake Okeechobee, and the Islands off of southern Florida (Fig. 14). This subspecies has been collected from February 25 to the beginning of July. In addition to the type material listed above, 19 females and 38 males were examined from the localities listed below. This list includes localities of type specimens.

Florida: Everglade, Dade Co.; Flamingo; Goulds; Homestead; * Lake Okeechobee; * Lake Worth; Lower Metacumba Key; * Mathewson Hammock; Miami; * Palm Beach; Paradise Key; Royal Palm Hammock; Royal Palm State Park; * South Bay, Lake Okeechobee; Trail City.

Melissodes (Melissodes) leprieuri Blanchard

Melissodes leprieuri Blanchard, 1849, *in* Cuvier, Le Règne Animal (ed. 3), insectes, vol. 2, p. 216, atlas pl. 128 *bis*, fig. 4.
Melissodes maura Cresson, 1865, Proc. Ent. Soc. Philadelphia, vol. 4, p. 188 (new synonymy); Cockerell, 1906, Trans. Amer. Ent. Soc., vol. 32, p. 81; Cresson, 1916, Mem. Amer. Ent. Soc., vol. 1, p. 123.

This is another melanistic species closely allied to *M. bimaculata.* The females of *leprieuri* can be distinguished from those of *morrilli* by the dark scopal hairs and by the completely dark vestiture of the metasoma. The females can be separated from those of *bimaculata* by the presence of a thin band of dark brown to dark ochraceous pubescence on the second metasomal tergum and by the finer punctation of the apical areas of terga 2 and 3. The males are easily separated from those of *maesta* and *labiatarum* by their darker

* Localities from the zone of intergradation.

color (legs and metasoma without white hairs or pubescence), and can be separated from the darkest males of *bimaculata* by the presence of a thin, median, narrowly interrupted band of dark brown pubescence on tergum 2.

Female. Measurements and ratios: N, 20; length, 10-13 mm.; width, 4-5 mm.; wing length, $M = 3.96 \pm 0.153$ mm.; hooks in hamulus, $M = 14.35 \pm 0.150$; flagellar segment 1/segment 2, $M = 2.03 \pm 0.021$.

Structure and color: Black; distitarsi dark red and often legs entirely dark red; antennae black, flagella usually slightly paler beneath; eyes black to gray-green; wing membranes deeply infumate, veins dark brown to black. With structural characters of *communis* with the following differences: maxillary palpal segments in ratio of about 3:3:2:1; eyes considerably less than three times as long as wide in facial view; clypeus with round deep punctures separated mostly by half of one puncture width, without a distinct median carina or boss, ground areas dulled by coarse shagreening; mesoscutum with deep round punctures separated by two or more puncture widths in posteromedian area, almost always with a small oval impunctate area about twice as wide as long posteromedially, often with a few scattered punctures in midline dividing this area into two rounded impunctate areas; propodeum dulled by coarse shagreening; first metasomal tergum with punctures of basal area small, round, distinct, separated mostly by one puncture width or less, ground shagreened but moderately shiny; tergum 2 with small distinct punctures in interband zone; apical areas of terga 2 and 3 with small distinct punctures separated by one to three puncture widths, ground finely shagreened, moderately shiny.

Hair: Head, thorax and metasoma with dark brown to black hairs, distal pubescent band of tergum 2 occasionally completely ochraceous, or ochraceous laterally, rarely distal pubescent band of tergum 3 ochraceous at extreme sides. Fore and middle legs, hind coxae, femora, basitibial plates and distitarsi with dark brown to black hairs, except rufescent hairs of inner surfaces of fore and middle basitarsi; scopal hairs usually entirely black, often those of at least distal halves of tibiae and basal halves of basitarsi bright yellowish-red; hairs of inner surfaces of hind basitarsi black to dark reddish-brown; inner surfaces of hind tibiae with long brown to black hairs laterally and short yellow to red hairs medially.

Male. Measurements and ratios: N, 2; length, 12 mm.; width,

3.5 mm.; wing length, 3.61-3.73 mm.; hooks in hamulus, 12-14; flagellar segment 2/segment 1, 5.71-5.96.

Structure and color: Color as in female except as follows: clypeus and labrum yellow; bases of mandibles with triangular yellow spots; flagellae, except first and last segments, red beneath; apical margins of terga 2-5 slightly translucent, dark brown. Structure as in female with the following differences: eyes strongly converging below, slightly more than twice as long as wide in facial view; minimum length of first flagellar segment equal to less than twice length of pedicle and about one sixth of maximum length of second segment.

Genitalia and hidden sterna much as in *communis*; gonostyli capitate, truncate and curved slightly dorsally near apices.

Hair: Head, thorax and metasoma with black to dark brown hairs; tergum 2 with median lateral fasciae of dark brown pubescence equal in width to one third width of tergum and often more, these fasciae not pale in the two specimens available, as sometimes occurs in females; terga 3 and 4 with complete thin distal bands of dark brown pubescence. Hairs of legs dark brown to black except rufescent hairs of inner surfaces of tarsi and hind tibiae.

Type material. Type material of *leprieuri* lost and probably destroyed, according to the authorities of the Paris Museum. Blanchard did not give a type locality with his illustration of this species. Female holotype of *maura* from Cuba is in the Academy of Natural Sciences of Philadelphia.

Distribution. Known only from Cuba. This species has been taken from August 2 to September 30. In addition to the holotype of *maura*, 23 females and 2 males have been examined from the localities listed below.

Havana: Cotorro, Santiago de las Vegas. Oriente: Guana; Guantánamo (San Carlos Est.); Upper Yara Valley. Piñar del Rio: Piñar del Río; Viñales (north of). Santa Clara: Baños de Ciego, Montero; Buenas Aires, Trinidad Mts.; Castillo de Jagua; Guabairo; Zaza de Media.

Melissodes (Melissodes) tepida Cresson.

This is a distinctive species related to *communis*, but not closely so. *M. tepida* is distinguished in both sexes by its small size, by having a broad distal pale band on tergum 2 and by the moderately shiny, distinctly punctate, narrow apical areas of terga 2 and 3. The distal band of tergum 2 is usually wider than the apical area

medially and often as much as twice as wide. The male usually has the first flagellar segment relatively long, as in *communis,* and the terminalia essentially as in *communis,* although the form of the seventh sternum is somewhat different as described below. The female has the lateral flattened areas of the vertex and the basal area of the first metasomal tergum much more coarsely punctate than in *communis* and often has the hairs of the inner surfaces of the hind basitarsi black or dark brown.

Female. Measurements and ratios: N, 20; length, 9.5-12.0 mm.; width, 3-4 mm.; wing length, $M = 3.55 \pm 0.200$ mm.; hooks in hamulus, $M = 13.90 \pm 0.214$; flagellar segment 1/segment 2, $M = 2.02 \pm 0.025$.

Structure and color: Black except as follows: distitarsi, often basitarsi and occasionally tibiae and hind femora dark red; sterna and lateral surfaces of terga often red; first tergum often with an extremely narrow hyaline apical margin; mandibles with apical halves red, often with large longitudinal golden maculae in apical halves; antennal scapes and first two flagellar segments black to dark brown, remaining segments yellow to red below, black above; eyes pale blue to greenish-blue; wing membranes slightly or not at all infumate, veins dark reddish-brown to black, darker anteriorly and apically. Clypeus with small, round, crowded punctures separated by less than one puncture width, rather evenly spaced in posterior half to two thirds, smaller and more crowded anteriorly, usually with an ill-defined median boss about one third of distance from apical margin, ground shiny, with delicate, sparse transverse shagreening; supraclypeal area usually with abundant coarse punctures, ground dulled by dense shagreening; vertex with flattened lateral areas with large round punctures separated mostly by about one puncture width, ground dulled by delicate irregular shagreening; maxillary palpal segments in ratio of about 3:3:2.5:1, fourth segment occasionally somewhat longer; galeae shiny dorsally, but often somewhat dulled by fine reticular shagreening, especially in apical half. Mesoscutum and scutellum with sculpturing as in *communis,* but posterior half or more of mesoscutum with punctures separated by two or more puncture widths and often with large posteromedian impunctate area; lateral faces of mesepisterna with punctures separated largely by less than half of one puncture width, about equal in diameter to those of anterior half of mesoscutum, ground areas often dulled by fine shagreening; dorsal face of propodeum with large crowded punctures in apical

half; reticulorugose basally, declivous face and lateral faces as in *communis*. First metasomal tergum with large round punctures separated by one half to one puncture width in basal three fifths or less, ground moderately shiny, with fine transverse shagreening; tergum 2 with small punctures separated by one to two puncture widths medially and one or less laterally in interband zone; terga 3 and 4 with small round punctures separated by one puncture width or less in basal areas; terga 2 and 3 with narrow apical areas with exceedingly small, but distinct, punctures separated from their nearest neighbors by one puncture width or less, ground areas shiny to moderately so, with delicate transverse shagreening.

Hair: On head white, often pale ochraceous on vertex and vertex usually with a few to many black or dark brown hairs. Scutellum with large median patch of dark brown hairs fringed with pale ochraceous; mesoscutum with large square patch of dark brown hairs in posteromedian area, often extending forward to a transverse line at anterior margins of tegulae, occasionally larger and often smaller than this, anterior margin often irregular, pale hairs white to ochraceous and occasionally somewhat ferruginous; lateral surfaces of thorax with pale ochraceous to white hairs; vestiture of metasoma as in *communis* but bands on each tergum usually broader and often pubescence pale ochraceous or slightly ferruginous rather than white. Additional color characters are described below for each subspecies.

Male. Measurements and ratios: N, 20; length, 7.5-11.0 mm.; width, 2-4 mm.; wing length, M = 3.20 ± 0.250 mm.; hooks in hamulus, M = 12.55 ± 0.135; flagellar segment 2/segment 1, M = 4.19 ± 0.156.

Structure and color: Color as in female except as follows: clypeus pale yellow to cream-colored; bases of mandibles with large pale yellow spots which cover entire basal width of each mandible and always larger than depressed triangular area; labrum white to cream-colored; antennal scape and pedicle dark brown to black; first flagellar segment dark reddish-brown, often with pale red ventral area, remaining segments yellow to red beneath and reddish-brown to black above; apical areas of terga 2-5 often hyaline apically but rarely completely colorless and then in worn faded specimens, usually piceous and opaque. Minimum length of first flagellar segment equal to slightly less than one sixth to slightly more than one third (usually about one fifth) of maximum length of second segment; maxillary palpi and galeae as in female; sculpturing as in

female with the following differences: clypeus with punctures obscure, lateral areas of vertex with ground areas often completely dulled by fine shagreening and often completely smooth and shiny, first metasomal tergum with basal four fifths or more coarsely punctate, interband zone of tergum 2 with punctures separated mostly by one puncture width or slightly more, apical areas of terga 2 and 3 with small piliferous punctures usually restricted to narrow zone just apical to pubescent bands and with narrow apical impunctate areas broader than in female.

Terminalia much as in *communis*. Sternum 7 with median plates often slightly flattened and much less oblique than in *communis*, often with apical margin almost transverse; median carinae each narrow and together forming a V-shaped or sub-Y-shaped structure. Sternum 8 usually with slightly shorter hairs at apex than in *communis*, with shallow median emargination; ventral longitudinal carina short, not reaching apex of sternum (Figs. 77-78).

Hair: Generally as in female but pale hairs more often white and brown hairs often absent on vertex and mesoscutum and sparser on scutellum; metasomal tergum 5 with a complete pale pubescent band; additional characters of vestiture are described for each subspecies.

Bionomics. As in most species of *Melissodes,* little is known concerning the details of nesting habits and life history of *M. tepida.* Linsley (1946, p. 25) gives the following brief account of the nesting habits of *M. tepida timberlakei*: "The species nests in bare ground at a depth of from three to six inches, well within the depth of cultivation. The entrance tunnel is about 6 mm. in diameter and enters perpendicularly for about three inches, then turns abruptly at right angles. The nest series consists of cells placed vertically in short extensions from the main shaft. A brief account of the nesting habits has been given by Hicks (1926)." This account is rather surprising because of the shallowness of the nests reported therein. Also, the reference to Hicks' paper is in error. Hicks in his 1926 work described nests of bees occurring in Colorado and makes no mention of *M. tepida* or *timberlakei.* Mr. R. R. Snelling of Turlock, California, in a personal communication, informs me that *timberlakei*, "nests in large colonies . . . on very hard ground . . . is parasitized by *Triepeolus timberlakei* and *T. lineatulus.*"

A large amount of information is available concerning the flowers visited by *M. tepida*, due chiefly to the excellent collections made by Mr. P. H. Timberlake of the Citrus Experiment Station, River-

TABLE V.—Summary of floral records for *Melissodes tepida*.

Plant data				Records of *M. tepida*			
Family	Number of Families	Number of Genera	Number of Species	Number of Collections	Number of Females	Number of Males	Total Number of Bees
Compositae	1	14	20	73	48	50	98
Leguminosae	1	8	11	108	245	125	370
Labiatae	1	4	5	37	40	18	58
Euphorbiaceae	1	2	2	39	42	24	66
Boraginaceae	1	2	2	20	47	47	94
Others	14	24	33	64	65	52	117
Totals	19	54	73	241	487	316	803

side, California. *M. tepida* is a polylectic species, as are most members of the subgenus *Melissodes*. From the tabulation (Table V) it is apparent that legumes form an important food source for this species. The figures for legumes are considerably exaggerated, however, due to collections made by entomologists studying pollination of alfalfa by wild bees; over 50 of the collections from legumes are from alfalfa. The composites are not used to any great extent with the exception of *Gutierrezia sarothrae* and *G. californica* which account for 24 of the collections from composites. In addition, although *tepida* has often been collected on many species of composites, only a few specimens were collected at any one time, except in the case of *Gutierrezia*. The high ratio of males to females on the composites, if *Gutierrezia* is omitted (on which the ratio is 3:10), and on the Borraginaceae indicates that these families are relatively of little importance as pollen sources. The conclusions that may be drawn from these data are that *M. tepida* is a polylectic species, visiting many species of plants for pollen as well as nectar, but shows some preference for the families Leguminosae, Labiatae and Euphorbiaceae, and for the one composite genus, *Gutierrezia*.

Geographical variation. *M. tepida* is divisible into three geo-

graphical races, one southern, one northern east of the Sierra Nevada Mountains, and the third west of the Sierras in California and Oregon (Fig. 16). The southern subspecies (*yumensis*) is dis-

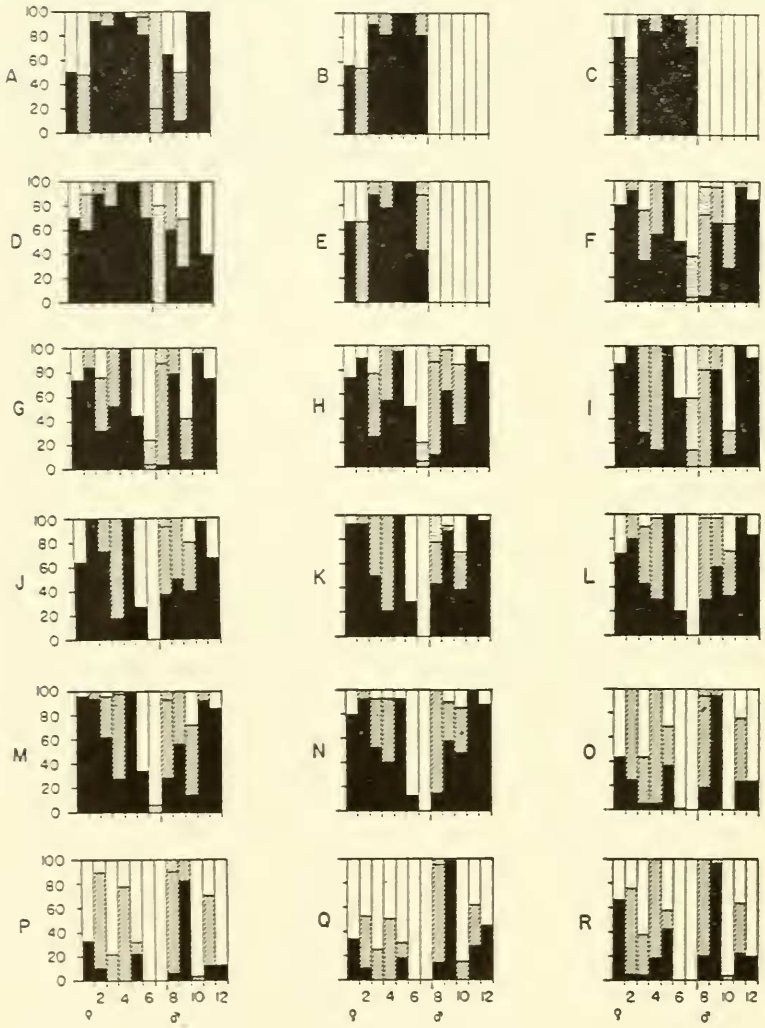

FIG. 15. Histograms showing percentages of individuals (ordinates) of *M. (Melissodes) tepida* bearing certain characters (abscissas) (see text for full explanation). Characters 1 through 7 refer to females and 8 through 12 to males. Each graph is lettered in accord with the areas outlined by broken lines on the map (Fig. 16). The number of individuals from each area studied is given in the explanation of figure 16.

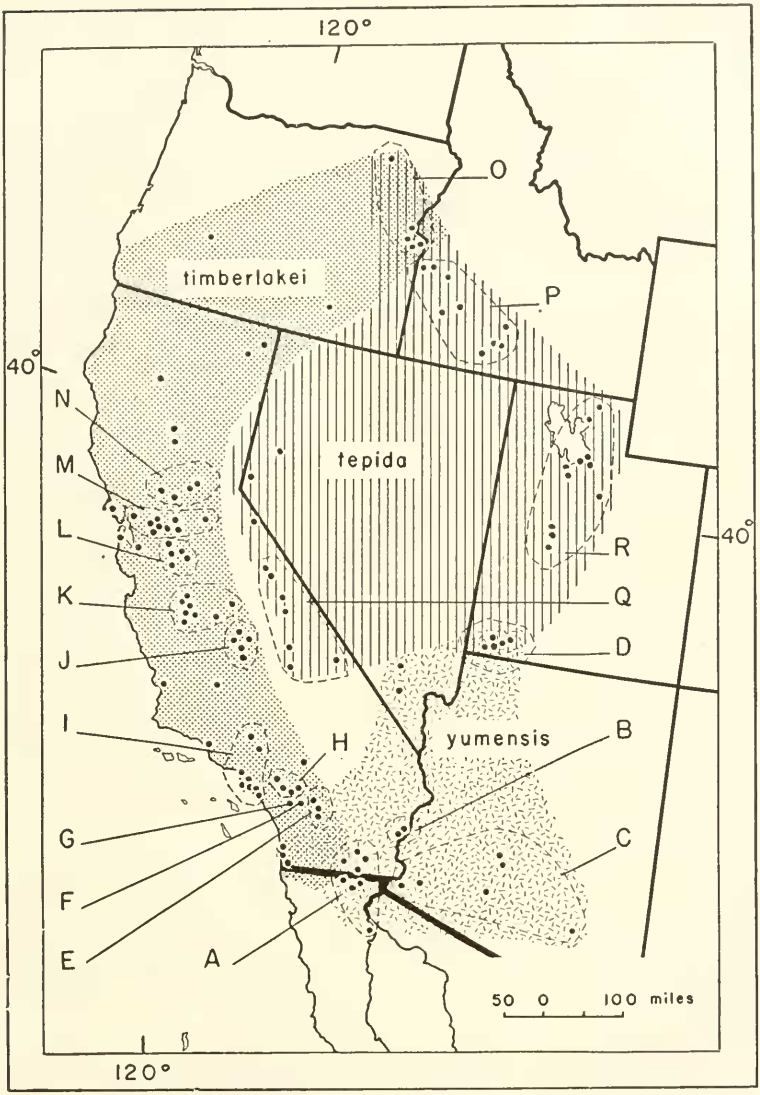

FIG. 16. Map showing the distribution of *M. (Melissodes) tepida*. Areas of overlapping types of shading indicate zones of intergradation between the subspecies. Numbers of specimens used from each area to produce the graphs of Figure 15 are listed below (female precedes male in each case): A 27, 20; B 11, 0; C 22, 5; D 10, 10; E 9, 0; F 50, 40; G 25, 24; H 40, 30; I 7, 10; J 11, 30; K 14, 23; L 30, 30; M 50, 14; N 15, 40; O 22, 21; P 13, 34; Q 91, 78; R 21, 30.

tinctive due to the dark hairs of the inner surfaces of the hind basitarsi of the female and the shorter first flagellar segment of the male. Intergrades between the southern subspecies and the northeastern subspecies (*tepida s. str.*) occur in southwestern Utah.

Intergrades between the southern subspecies and the northwestern subspecies (*timberlakei*) occur in the Palm Springs-Coachella Valley area and in the San Diego area of southern California. From Hemet on the west side of the San Jacinto Mountains, approximately twenty four miles from Palm Springs, California, in a straight line, a long series of males and females collected by J. W. MacSwain show that, although a few somewhat darker specimens are present, more than 90 per cent are typically *timberlakei* and none is so dark as the intermediates from Palm Springs and the Coachella Valley. Additional long series from Winchester and Riverside, California, resemble the Hemet series. The zone of intergradation seems to be narrow in this area, although how far it extends to the east is not known, since no specimens are available from California between Coachella Valley and Blythe. The San Jacinto Mountains seemingly form a rather effective barrier to gene flow in this area. Two specimens from Coronado, San Diego County, show that the zone of intergradation probably extends southwest from the Coachella Valley region, since one is typically *timberlakei* and the other is intermediate. Another intermediate female from Seeley, Imperial County, has been examined, and a few females with somewhat darker legs have been seen from Orange and Los Angeles counties.

To the north it seems likely that *tepida s. str.*, *timberlakei* and *yumensis* come together in the vicinity of the Mojave Desert or northern San Bernardino County, California. However, only four males from Hodge are available from that area and these can be readily assigned to the subspecies *timberlakei.* The subspecies *yumensis* probably also intergrades with *tepida s. str.* in southern Nevada, but there is no evidence of this at present.

Farther north *timberlakei* meets *tepida* in western Oregon where a series of intermediate specimens plus examples typical of each subspecies are known. Some gene flow perhaps occurs across the Sierras in the vicinity of Lake Tahoe, but again the few specimens available from that area do not permit definite conclusions. The long series of specimens from the Owens Lake Region in California are typical *tepida,* but, as elsewhere in the range of *tepida s. str.,* a small percentage of individuals are indistinguishable from the palest specimens of *timberlakei.*

In figure 15 are given histograms of certain characters of both sexes for various general localities in the range of each of the three subspecies. These graphs were produced in a fashion similar to that used for *M. obliqua*. For some characters three alternatives and for two characters (one male and one female) four alternatives were tabulated, rather than simply a pale and a dark alternative for each character as was done in *obliqua*. These alternatives are shown by various types of shading of the bars in the graphs. The graphs show that each locality has a rather distinctive set of characters differing from its neighbors in one particular or another. However, within each subspecies, certain similarities in pattern can be seen. It is evident that some individuals of *tepida s. str.* and *timberlakei* must be indistinguishable from one another. In the females these represent less than 10 per cent of the specimens available for study. However, about 25 per cent of the males are indistinguishable due to the greater variability of the males in all characters. The graph for the northern Utah region (R) is very similar to that for the zone of intergradation between *tepida* and *timberlakei* in eastern Oregon. In the case of the Utah specimens the general darkness is more likely due to gene flow from *yumensis* to the south rather than from *timberlakei* far to the west, although this series, if situated elsewhere, would be considered as a series of intergrades with the latter.

The ring of subspecies thus formed (Fig. 16) is a rather unequal circle in that the subspecies *yumensis* is much more distinct from either of the other two subspecies than the latter are from each other. It seems likely that, to produce a structural change such as the relative lengths of the first flagellar segments of the male in *yumensis*, the populations must have been isolated for a considerable period of time. The chief character distinguishing the females of *yumensis* (dark hairs on the inner surfaces of the hind basitarsi) is also a rather fundamental difference, since it is a departure from the usual color for the subgenus as a whole, and since it does not vary in or near the zones of intergradation. What the barrier was which presumably separated the populations which evolved into the subspecies *yumensis* is not clear.

On the other hand, the differences between *tepida s. str.* and *timberlakei* are of such an order that they could and probably did arise through shifts in gene frequencies in populations partially isolated for a considerable period of time. The incomplete barrier in this case has probably been the Sierra Nevada Mountains.

The characters used in preparing the bar graphs (Fig. 15) are listed below. Characters 1 through 7 refer to females, while characters 8 through 12 refer to males. The type of shading on the graphs is given in parentheses immediately after each alternative of a character.

Female:

1a. Mesoscutal patch of dark hairs reaches forward to or beyond a transverse line at the anterior margins of the tegulae (black).
1b. Mesoscutal dark patch not reaching a transverse line at anterior margins of tegulae (white).
2a. Black hairs on vertex abundant (black).
2b. Black hairs on vertex few (crosshatched).
2c. Black hairs on vertex absent (white).
3a. Tergum 2 with hairs of interband zone all or almost all dark brown to black (black).
3b. Tergum 2 with lateral third or less of interband zone with pale hairs (crosshatched).
3c. Tergum 2 with hairs of interband zone all pale (white).
4a. Apical area of tergum 3 with hairs all dark brown or dark brown in more than median third (black).
4b. Apical area of tergum 3 with hairs dark in median one third to one fourth (crosshatched).
4c. Apical area of tergum 3 with hairs mostly or all pale (white).
5a. Distal pale band of tergum 2 less than one and a half times as broad as apical area medially (black).
5b. Distal pale band of tergum 2 one and a half times as broad as apical area medially or broader, but less than twice as broad (crosshatched).
6a. Median apical patch of brown hairs present on tergum 4 (black).
6b. Median apical patch of brown hairs absent on tergum 4 (white).
7a. Hairs of inner surfaces of hind basitarsi black to dark brown (black).
7b. Hairs of inner surface of hind basitarsi reddish-brown (crosshatched).
7c. Hairs of inner surfaces of hind basitarsi orange-red to red (stippled).
7d. Hairs on inner surfaces of hind basitarsi orange to yellow (white).

Males:

8a. Ratio of second/first flagellar segments 4.0 or less (black).
8b. Ratio of second/first flagellar segments 5.0-4.1 (crosshatched).
8c. Ratio of second/first flagellar segments 6.0-5.1 (stippled).
8d. Ratio of second/first flagellar segments more than 6.0 (white).
9a. Mesoscutal patch of dark hairs as large as or larger than scutellum (black).
9b. Mesoscutal patch of dark hairs smaller than scutellum (crosshatched).
9c. Mesoscutal patch of dark hairs absent (white).
10a. Hairs of interband zone of tergum 2 all brown or brown in more than median third (black).
10b. Hairs of interband zone of tergum 2 brown in median third or less (crosshatched).
10c. Hairs of interband zone of tergum 2 all pale (white).
11a. Tergum 3 with hairs of apical area all brown or brown in more than median half (black).
11b. Tergum 3 with hairs of apical area brown in median half or less (crosshatched).
11c. Tergum 3 with hairs of apical area all pale (white).
12a. Tergum 4 with dark hairs in apical area at least medially (black).
12b. Tergum 4 without dark hairs in apical area (white).

A few of the areas outlined on the map (Fig. 16) and represented by histograms (Fig. 15) consist of single or of few localities. These are as follows: B—Blythe and Ripley, Riverside County; E—Coachella Valley area; F—Hemet, Riverside County; G—Winchester, Riverside County; H—Riverside area and southwestern San Bernardino County area. The remaining areas outlined on the map are easily recognized by reference to a standard map of the region.

Melissodes (Melissodes) tepida tepida Cresson.

Melissodes tepida Cresson, 1878, Proc. Acad. Nat. Sci. Philadelphia, vol. 30, p. 210; Cockerell, 1906, Trans. Amer. Ent. Soc., vol. 32, p. 85; Cresson, 1916, Mem. Amer. Ent. Soc., vol. 1, p. 131.

This subspecies can be distinguished from the other two subspecies by the generally pale color of the vestiture. The females can be separated from those of *yumensis* by the yellow to red hairs of the inner surfaces of the hind basitarsi. The males can be sepa-

rated from those of *yumensis* by the longer first flagellar segments and by the usually paler color of the hairs of the terga as described below. The females of *tepida* can be separated from those of *timberlakei* by the first of the four following characters plus any two of the remaining three: tergum 4 without dark brown hairs medially; vertex with few to about twenty long dark brown hairs, or these absent, and short hairs all or almost all pale; short suberect hairs of apical area of tergum 3 all pale or pale in lateral fourth or more; interband zone of tergum 2 with suberect hairs all pale or dark in medial third or less. The males of *tepida* can be separated from those of *timberlakei* by having two of the following three characters: mesoscutum without dark brown hairs; interband zone with hairs all or almost all pale (dark in median third or less, if at all); apical area of tergum 4 with suberect hairs all pale or pale in at least lateral fourth. Additional characters described below can be assessed by reference to the histograms (Fig. 15).

Female. Hairs of head and thorax white to pale ochraceous, rarely somewhat rufescent on mesoscutum anteriorly; vertex usually with a few to about twenty long dark brown hairs, often all pale, short hairs between lateral ocelli and apices of compound eyes usually white; dark hair patch of mesoscutum usually not extending forward to a transverse line at anterior margins of tegulae, rarely exceeding this line, anterior margins of dark patch often irregular and diffuse due to intermixture of pale hairs. Tergum 2 with distal pale band rarely narrower than one and one half of width of apical area medially and often twice as wide or more, interband zone narrower than distal band, usually with suberect hairs all white to yellow, often brown in median third or less; tergum 3 with pale band usually broader than three times width of narrow apical area medially, apical area with short suberect hairs usually white at least in lateral fourths and often entirely so (as in holotype); tergum 4 usually without dark brown hairs medially near apex, rarely a few dark hairs present; sterna usually with yellowish-brown hairs, with white hairs apically and laterally on each sternum except the last. Legs with white to pale ochraceous hairs except as follows: distitarsi ochraceous to rufescent; outer surfaces of fore basitarsi, tips of middle tibiae and basitibial plates brown; inner surfaces of basitarsi yellow to red.

Male. Minimum length of first flagellar segment usually equal to one fourth to one fifth of maximum length of second segment, occasionally as long as one third and rarely as short as one sixth

of second segment. Pale hairs of head and thorax white to pale ochraceous; vertex without brown hairs; mesoscutum usually without brown hairs, occasionally with a few in posteromedian area. Pale pubescence of terga white to pale ochraceous; tergum 2 with interband zone narrow, with suberect to erect hairs white to yellow, occasionally brown in less than median third; tergum 3 with apical area usually with suberect hairs pale in outer fourth or more and dark brown in median half or less, often entirely pale; tergum 4 similar to tergum 3; tergum 5 usually without dark hairs medially at apex or with very few; terga 6 and 7 rarely with all hairs yellowish, usually brown at least medially; sternal hairs usually white to yellow, often yellowish-brown on last two sterna. Legs with white hairs except as follows: inner surfaces of tarsi and hind tibiae yellow to orange; basitibial plates often brown.

Type material. Holotype female from Nevada is in the Academy of Natural Sciences of Philadelphia.

Distribution. Northern half of Utah and Nevada west to the Sierra Nevada Mountains in California, north to northwestern Oregon and the southern half of Idaho (Fig. 16). This subspecies has been collected from May 26 to August 25, but mainly during July. In addition to the holotype, 152 females and 145 males have been examined from the localities listed below.

California: Bishop, Inyo Co.; Big Pine, Inyo Co.; Convict Lake, Mono Co.; Furnace Creek, Inyo Co.; Lone Pine, Inyo Co.; Mammoth, Mono Co.; Olancha, Inyo Co.; Owens Lake, north end, Inyo Co.; Topaz Lake, Mono Co. Idaho: Balanced Rock; Bliss; Boise; Fruitland; Grand View; Hazelton (3 miles N. E.); Hot Spring, Owyhee Co.; Kimberly; Mt. Home; Parma; Twin Falls. Nevada: Nixon; Sparks. Oregon: * Huntington (10 miles N.); * Malheur Co.; * Meachem; * Ontario; * Vale. Utah: Corinne; Delta; Erda; Garfield; Logan; North Delta; Pahvant; Provo; Saltair; Salt Lake City; Stockton.

Flower records. Asclepias sp., *Astragulus bolanderi, Glycyrrhiza lepidota, Helianthus* sp., *H. annuus, Medicago sativa, Melilotus* sp., *Mentha* sp., *Trifolium* sp., *T. pratense.*

Melissodes (Melissodes) tepida timberlakei Cockerell.

Melissodes timberlakei Cockerell, 1926, Ann. Mag. Nat. Hist., ser. 9, vol. 18, p. 624; Linsley, 1946, J. Econ. Ent., vol. 39, pp. 20-23, 25 (in part); Linsley and MacSwain, 1947, J. Econ. Ent., vol. 40, p. 352 (in part).
Melissodes tepida, Fowler, 1902, Report of the work of the Agric. Exp. Stat. of the Univ. of California, 1898-1901, pt. 2, pp. 322, 323 (misidentification); Cockerell, 1903, Psyche, vol. 10, p. 77 (misidentification).

* Localities from the zone of intergradation.

This subspecies can be distinguished from the subspecies *yumensis* by the same characters serving to separate *tepida s. str.* and from *tepida s. str.* by the characters listed in the diagnosis of the latter.

Female. Pale hairs of head usually ochraceous on vertex, becoming paler on face and genal areas, often faded to white in worn specimens; vertex usually with abundant long dark brown hairs, occasionally with few dark hairs but these never completely lacking, usually with abundant short brown hairs between lateral ocelli and apices of compound eyes and extending onto face medially. Mesoscutum with pale hairs usually ochraceous, occasionally rufescent, often white to pale ochraceous (especially in worn specimens), with posteromedian patch of dark hairs usually extending forward to or beyond a transverse line at anterior margins of tegulae, often somewhat broader near anterior margin than posteriorly; scutellum with dark brown hairs fringed posteriorly by pale ochraceous to white hairs; lateral and ventral surfaces of thorax and propodeum with white to pale ochraceous hairs, paler below. Tergum 2 with interband zone usually with suberect dark brown hairs except at extreme sides, often dark zone restricted to median third of tergum and occasionally less, rarely dark hairs absent, distal pale band of tergum 2 usually equal to about one and one half of width of apical area medially, occasionally less, but then usually due to wear, rarely as broad as two times apical area; tergum 3 with broad pale band usually equal to three times width of apical areas medially or less, apical area usually with suberect dark brown to black hairs except at extreme sides, rarely lateral fourth with pale hairs; tergum 4 often with at least a few dark brown hairs medially near apex; sternal hairs usually dark brown except pale ochraceous to white apically and laterally on each sternum but the last. Legs with color of hairs as in *tepida s. str.* but often dark brown areas on apices of middle tibiae and surrounding basitibial plates slightly larger and hairs of anterior tarsi darker brown.

Male. Minimum length of first flagellar segment usually equals one fourth to one fifth of maximum length of second segment, often as long as one third and rarely as short as one sixth of second segment. Characters of vestiture as in *tepida s. str.* with the following differences: pale hairs and pubescence usually ochraceous and often slightly ferruginous, white to pale ochraceous especially in worn specimens; vertex occasionally with a few brown hairs; mesoscutum usually with at least a few brown hairs in postero-

median area, often brown patch as large as or larger than that on scutellum; interband zone of tergum 2 usually with dark brown suberect hairs in at least median third but often entirely white to yellow; apical area of tergum 3 usually with dark brown suberect hairs except at extreme sides, occasionally with pale hairs in lateral fourth or slightly more, rarely dark hairs lacking; tergum 5 usually with at least a few dark brown to black hairs medially near apex; terga 6 and 7 never without brown hairs and these usually abundant.

Type material. Holotype female from Riverside, California, August, 1926, P. H. Timberlake and T. D. A. Cockerell, is in the collection of the University of Colorado Museum, Boulder, Colorado.

Distribution. San Diego in southern California northeast through the Mojave Desert to the Sierra Mountains, north through California west of the Sierras to the southern half of Oregon (Fig. 16). This subspecies has been collected from April (presumably the latter part of the month) to October 23, but mainly in June and July. In addition to the holotype, 612 females and 474 males have been examined from the localities listed below. This list includes localities reported in the literature.

California: Alturas; Antioch, Contra Costa Co.; Arvin; Auburn; Byron; Chico; Chula Vista; Corona; Corral Hollow, San Joaquin Co.; Costa Mesa; Davis; Dos Palos, Madera Co.; Exeter; Fairmont Lake; Firebough, Fresno Co.; Fresno; Friant; Hemet; Hodge, San Bernardino Co.; Hospital Canyon; Lake City; Lindsay; Live Oak Canyon, Riverside Co.; Lodi; Long Beach; Loomis; Los Angeles Co.; Lower Panoche Creek, Fresno Co.; Mendota; Miles; Millbrae, San Mateo Co.; Modesto; Mokelumna Hill; Nelson; New Port, Los Angeles Co.; Newport Bay, Orange Co.; Oakley; Ontario; Oxalis; Patterson; Pt. Muga, Ventura Co.; Redding; Redlands; Rio Vista; Riverside; Romaland, Riverside Co.; Ryer Island; Sacramento; San Diego; San Pedro; Santa Monica; Seal Beach; Shafter, Kern Co.; Sherman Island; Stockton; Three Rivers; Tomales Bay; Tracy; Tranquility; Turlock; Visalia; Westley; Winchester; Wood Lake, Tulare Co. Oregon: Alford Hot Springs (N. of Andrews, Harney Co.); Diamond Lake, Douglas Co.

Flower records. Althaea rosea, Asclepias eriocarpa, Aster sp., *Bellis* sp., *Brassica* sp., *B. adpressa, B. incana, Centaurea cyanus, Centromadia pungens, Cleomella* sp., *Coreopsis* sp., *C. lanceolata, Croton californicus, Cryptantha intermedia, Cucurbita* sp., *Daucus carota, Duranta plumieri, Eremocarpus* sp., *E. setiger, Eriogonum* sp., *E. fasciculatum, E. gracile, E. involucratum, Eschscholtzia*

californica, Gilia capitata, Godetia amoena, Gutierrezia californica, G. sarothrae, Helianthus sp., *H. annuus, H. bolanderi, H. petiolaris, Heliotropium* sp., *H. curassavicum, Hugelia virgata, Lippia filiformis, L. lanceolata, Lotus* sp., *L. americanus, L. scoparius, Madia* sp., *Marrubium vulgare, Medicago* sp., *M. sativa, Melilotus* sp., *M. alba, M. indica, Papaver heterophyllum, Phacelia ramosissima, Phaseolus* sp., *Pluchea borealis, P. camphorata, P. sericea, Rhaphanus* sp., *Salsola* sp., *S. kali, Scabiosa* sp., *Senecio douglasi, Stachys ajugoides, S. bullata, Stephanomeria exigua, S. virgata, Trichostema* sp., *T. lanceolatum, Trifolium* sp., *T. involucratum, T. repens, Wislizenia refracta.*

Melissodes (Melissodes) tepida yumensis, subsp. nov.

Melissodes timberlakei, Linsley, 1946, J. Econ. Ent., vol. 39, pp. 21, 25 (in part) (misidentification); Linsley and MacSwain, 1947, J. Econ. Ent., vol. 40, p. 351 (in part) (misidentification).

This subspecies can be separated from the other races of *M. tepida* by the dark hairs on the inner surfaces of the hind basitarsi of the female and by the relatively short first flagellar segments of the male.

Female. Vestiture as in *M. tepida timberlakei* with the following differences: pale hairs of head, thorax and terga paler, white to pale ochraceous; tergum 2 with dark suberect hairs of interband zone covering at least median third and usually more, distal pale band usually as broad as apical area medially or slightly narrower, occasionally as broad as one and one-half times apical area; tergum 3 with dark brown to black subappressed hairs in narrow apical area except at extreme sides; tergum 4 almost always with at least a few dark brown hairs medially at apex and often with patch of dark hairs equal to one sixth of width of tergum. Legs with hairs as in *timberlakei* except inner surfaces of hind basitarsi and often tibiae with dark brown to black hairs.

Male. Minimum length of first flagellar segment equals less than one fifth of maximum length of second segment and usually less than one sixth of second segment. Vestiture as in *timberlakei* with the following differences: pale hairs of head, thorax and terga paler, white to pale ochraceous; apical area of tergum 3 always with dark brown to black suberect hairs except at extreme sides; tergum 4 always with at least a few dark brown hairs medially at apex, unless worn, and usually with many dark hairs.

Type material. Holotype male from Yuma, Arizona, June 29, 1952, on alfalfa, S. Carl; allotype female and two paratype females

from Yuma, Arizona, May 12, 1952, on Palo Verde, G. D. Butler. Eleven females and three male paratypes from Yuma, Arizona, are as follows: 2 females, June 7, 1951, G. D. Butler; 1 female, June 10, 1951, G. D. Butler; 1 female, June 18, 1951, F. E. Todd; 1 female, June 1909, A. McLachland; 1 female, June 11, 1951, G. D. Butler; 2 females, June 21, 1951, G. D. Butler; 1 female, June 30, 1951, F. E. Todd; 1 male, June 18, 1952, on *Medicago sativa,* G. D. Butler; 2 females, May 23, 1953, G. D. Butler. Ten female and one male paratypes from Arizona are as follows: Gila Bend, 4 females, July 23, 1946, H. A. Scullen; 2 females, July 22, 1948, C. and P. Vaurie. Marinette, 1 female, July 6, 1950, H. C. Wright. Roll, 1 female, May 23, 1952, on *Medicago sativa,* F. E. Todd. Sabino Canyon, Santa Catalina Mts., 1 male, August 23, 1933, G. E. Bohart. Tolleson, 1 female, May 29, 1933, on *Sphaeralcea* sp., P. H. Timberlake. Ten female and three male paratypes from southern California are as follows: Blythe, Riverside Co., 7 females and 1 male, July 15, 1938, on *Lippia nodoflora,* P. H. Timberlake; 2 females, July 24, 1945, on *Medicago sativa,* E. G. Linsley; 1 male, July 20, 1946, on *Medicago sativa,* J. W. MacSwain; 1 male, July 11, 1949, Ray F. Smith. Ripley, Riverside Co., 1 female, October 19, 1951, on *Aster* sp., P. D. Hurd; 1 female, June 20, 1946, on *Medicago sativa,* J. W. MacSwain. The holotype and allotype are the property of the University of Arizona, but are on loan for an indefinite period to the Snow Entomological Museum of the University of Kansas. Paratypes are in the collections of the University of Arizona, the Citrus Experiment Station, Riverside, California, the California Academy of Sciences, the Snow Entomological Museum, the U. S. National Museum and in the author's collection.

Distribution. Northern Baja California, southeastern California, southern Nevada, southwestern Utah and Arizona (Fig. 16). This subspecies has been collected from May 12 to October 19, but mainly in June and July. In addition to the type material listed above, 47 females and 29 males have been examined from the localities listed below.

Arizona: "Ariz." California: Calexico, Imperial Co.; * Coachella Valley; * Coronado, San Diego Co.; Cronia; Imperial Co.; *Indio; * Palm Springs; * Seeley, Imperial Co.; Westmorland. Nevada: Arden (3 miles E.); Indian Springs. Utah: * Hurricane; * Leeds; * St. George; * Virgin; * Washington. Baja California: La Punta (6 kilometers E. and 7 kilometers N. E.); Mexicali (45 and 47 kilometers S. E., 35 kilometers S. W. and 42 kilometers S.).

* Localities considered as being in the zone of intergradation.

Flower records. Aster sp., *Cercidium torreyanum, Chilopsis linearis, Citrullus* sp., *Gossypium* sp., *Lippia nodoflora, Medicago sativa, Melilotus alba, Salix* sp., *Sida hederacea, Sphaeralcea* sp.

Melissodes (Melissodes) tepaneca Cresson.

Melissodes tepaneca Cresson, 1878, Proc. Acad. Nat. Sci. Philadelphia, vol. 30, p. 210.
Melissodes petalostemonis Robertson, 1900, Trans. Acad. Sci. St. Louis, vol. 10, p. 53 (new synonymy); 1905, Trans. Amer. Ent. Soc., vol. 31, p. 369; 1928, Flowers and Insects, p. 8.
Melissodes galvestonensis Cockerell, 1905, Proc. Biol. Soc. Washington, vol. 18, p. 181 (in part) (new synonymy); 1906, Trans. Amer. Ent. Soc., vol. 32, pp. 81, 84.
Melissodes bruesi Cockerell, 1906, Trans. Amer. Ent. Soc., vol. 32, p. 110 (new synonymy).
Melissodes loena Cockerell, 1909, Entomologist, vol. 42, p. 148 (new synonymy).
Melissodes masuca Cockerell, 1909, Entomologist, vol. 42, p. 148 (new synonymy); 1917, J. New York Ent. Soc., vol. 25, p. 191; 1923, Proc. U. S. Nat. Museum, vol. 63, p. 3.
Melissodes tepaneca aschenborniana Cockerell, 1912, Ann. Mag. Nat. Hist., ser. 8, vol. 10, p. 28 (new synonymy).
Melissodes aurescens Cockerell, 1949, Proc. U. S. Nat. Museum, vol. 98, p. 462.
Melissodes tepaneca panamensis, Michener, 1954, Bull. Amer. Mus. Nat. Hist., vol. 104, p. 132 (in part).

This species is quite distinct from the foregoing species and closely related to the West Indian species, *M. rufodentata.* The most distinctive characters involve the male terminalia and are as follows: the hairs on the bases of the gonostyli are short and sparse; the median plates of sternum 7 are greatly reduced and the ventral carinae enlarged as described below; sternum 8 has short, sparse hairs at the apex and a long ventral carina which is apically flattened into a peculiar diamond-shaped structure. Males of *rufodentata* share these peculiarities, but are separated from those of *tepaneca* on the basis of punctation as described in the diagnosis of the former.

Externally both sexes of *tepaneca* are practically indistinguishable from some specimens of both *comptoides* and *thelypodii.* The punctation of the thorax and metasoma is generally as in *comptoides*, although the punctures of the apical areas of the terga are generally smaller. The wing membranes of *tepaneca* are clear, unlike a large majority of individuals of *comptoides*, and the clypeus of the female has shallower punctures and more densely shagreened ground areas than in *comptoides.* The females of *tepaneca* can be separated from those of *M. thelypodii thelypodii* by the presence of dark hairs on the ventral surfaces of the mesepisterna and usually on the lower lateral and anterior surfaces as well. Males of *tepaneca* can be separated from those of *thelypodii s. str.* by the

presence of abundant dark brown hairs in the interband zone of tergum 2. Both sexes are extremely difficult to separate from *M. thelypodii stulta,* the characters listed in the diagnosis of the latter will separate most of the females, while all of the males can be identified only on the basis of characters of the terminalia.

Female. Measurements and ratios: N, 20; length, 9-13 mm.; width, 3-5 mm.; wing length, $M = 3.66 \pm 0.319$ mm.; hooks in hamulus, $M = 13.65 \pm 0.233$; flagellar segment 1/segment 2, $M = 1.85 \pm 0.034$.

Structure and color: Integument black except as follows: distitarsi and often hind basitarsi and tibiae rufescent; mandibles rufescent medially; flagella red below, dark brown to black above, except first two segments all dark; tegulae usually testaceous to reddish-brown, rarely darker; wing membranes clear, veins dark reddish-brown to black, darker apically; eyes grayish-black to yellowish-green. Sculpturing of head and thorax as in *comptoides* with the following differences: clypeus usually with somewhat larger, more crowded and shallower punctures, separated by half of one puncture width or less, ground areas and bottoms of punctures dulled by coarse shagreening; supraclypeal area coarsely punctate at least laterally, dulled by tessellation. Galeae shiny; maxillary palpi 4-segmented, in ratio of about 2:2:2:1, segments 3 and 4 often somewhat shorter; eyes in facial view distinctly narrower than three times as long as broad. Metasomal sculpturing as in *comptoides* with the following differences: tergum 2 with punctures of interband zone distinct and evenly distributed across tergum (not markedly smaller or sparser medially), separated by one to half of one puncture width (mostly by less than one); apical areas of terga 2 and 3 and tergum 4 medially with abundant piliferous punctures separated from their nearest neighbors by one to three puncture widths and equal in diameter to two or three times basal width of hairs arising from them, smaller, shallower and usually less distinct than in *comptoides,* but more abundant and distinct than in *communis;* apical areas of terga 1 to 3 with ground areas finely shagreened but moderately shiny.

Hair: On head white to pale ochraceous except abundant dark brown hairs on vertex. Mesoscutum and scutellum with abundant ferruginous hairs, becoming ochraceous in faded specimens, rarely with brown hairs in posteromedian area of mesoscutum or medially on scutellum; pale ochraceous on sides of thorax except ventral, anterior and often lower lateral surfaces of mesepisterna with

dark brown hairs; tegulae with pale hairs. Metasomal vestiture of *comptoides* with the following differences: pale pubescent bands usually pale ochraceous to pale ferruginous rather than white; tergum 2 with distal pale band usually wider than in *comptoides,* usually equal to about half of apical area medially and occasionally equal to apical area in width, not strongly arched as in *comptoides* but almost straight across tergum in median half and slightly oblique in lateral fourths, or gently arched, so that apical area laterally equals half of apical area medially and usually considerably more; pale apical band of tergum 4 with large median triangular or diamond-shaped area of dark brown to black suberect hairs, usually as broad as on fourth width of tergum and often broader. Legs with brown hairs except as follows: coxae and femora usually white or pale ochraceous; outer surfaces of fore and middle tibiae mixed brown and white; inner surfaces of tarsi and tibiae yellow to dark red, occasionally brownish-red on hind basitarsi; scopal hairs ochraceous to white with a few brown hairs around basitibial plates.

Male. Measurements and ratios: N, 20; length, 8-13 mm.; width, 3-4 mm.; wing length, $M = 3.38 \pm 0.373$ mm.; hooks in hamulus, $M = 12.75 \pm 0.228$; flagellar segment 2/segment 1, $M = 8.09 \pm 0.198$.

Structure and color: Integument black except as follows: clypeus and bases of mandibles yellow; labrum entirely white or cream-colored; distitarsi and often basitarsi and tibiae brownish-red to bright red; apical areas of terga usually somewhat translucent, but never completely colorless, terga and sterna often wholly reddish-brown; antennal scapes dark brown to black, flagellum yellow to red beneath and dark brown to black above, at least ventral half of each segment pale and usually more; tegulae usually testaceous; eyes gray to green. Minimum length of first flagellar segment equals one eighth of maximum length of second segment or less and about equal to pedicle; maxillary palpi and galeae as in female; eyes in facial view much less than three times as long as broad, strongly converging below. Punctation as in female with the following differences: vertex between apices of compound eyes and lateral ocelli with abundant punctures separated mostly by one to one and a half puncture widths, ground shiny, unshagreened; mesoscutum with abundant punctures in posteromedian area, but these often not distinctly separated into areas of larger and sparser punctures anteriorly and crowded smaller punctures posteriorly as in female,

punctures separated mostly by one puncture width or less; tergum 1 with distinct punctures almost to apical margin medially, but becoming progressively smaller from about half distance from base to apex; tergum 2 with punctures of interband zone often slightly sparser than in female; apical areas of terga 2 to 4 often with punctures somewhat sparser than in female.

Genitalia generally as in *communis;* gonostyli not distinctly capitate, with short, sparse hairs on outer surfaces in lower thirds. Sternum 7 with median plates reduced to small, ventrally curved structures about as wide as long and half as wide as lateral plates at that level or less, each separated from mid-point of median emargination of sternum by two to three times its own width; median ventral carina large, forming a broadly Y-shaped structure, each arm of which reaches and slightly surpasses apical margin of sternum immediately below median plates; apodemes long and thin. Sternum 8 usually with median apical emargination, or apical margin rounded, with sparse, minute hairs at apex; longitudinal ventral carina high and long, extending beyond apical margin of sternum by about one third of its own length, broadened and flattened at apex to form a flat diamond-shaped structure; lateral apodemes thin, sinuate along posterior margin and with a short, anteriorly directed process (Figs. 90-92).

Hair: Vestiture as in female except as follows: vertex of head usually without or with few dark brown hairs; mesoscutum and scutellum never with dark brown hairs; ventral, anterior and lower lateral surfaces of mesepisterna without dark hairs; metasomal tergum 2 more often with distal pale band as wide as apical area and rarely slightly wider, straight as in female; tergum 5 always with a complete apical pale pubescent band which has a small median apical patch of dark brown hairs; legs with pale ochraceous hairs except as follows: rufescent on inner surfaces of tarsi and usually hind tibiae; brown on basitibial plates and usually with a streak of brown hairs extending over basal half to three fourths of outer surfaces of hind tibiae.

Bionomics. M. tepaneca has been recorded visiting flowers belonging to at least fifteen families of plants. It is evident that a considerable degree of polylecty exists in this species. Seemingly, *tepaneca* does not use composites to any great degree as pollen sources. Out of 77 collections of bees from Texas bearing flower records (including 353 bees) only 21 are from composites, and in these 21 records only 33 bees are involved (22 females and 11

males). In contrast to this, 12 of the 77 collections are from *Opuntia* and these involve 146 bees (126 females and 20 males). There appears to be a decided preference for flowers of Cactaceae and Leguminosae, at least in Texas.

Robertson (1900) considered this bee as being restricted to *Petalostemon,* a legume, as indicated by the name he proposed for the species. This was an unfounded view, even considering the data concerning the flower activities of *tepaneca* in Illinois where, according to Robertson (1928), this species was collected from eight genera and seven families of plants. However, Robertson does not state what the bees were doing on various flowers, except in the case of *Petalostemon* on which he observed the females collecting pollen.

Geographic variation. This species is relatively uniform, considering the variation of other species belonging to this subgenus. The females vary considerably in the amount of dark hairs on the mesepisterna, but this does not follow any geographic pattern. Both sexes show variation in size throughout the range of the species and the specimens from Central America are, perhaps, slightly smaller on the average. The females from Panamá and Honduras often have wider distal pale bands on tergum 2 and often have slightly darker hairs on the inner surfaces of the hind basitarsi. These differences are slight, and in the relatively small series of specimens available they are not constant enough to permit the recognition of a Central American subspecies. If additional material reverses this position, the Central American race would be known as *M. tepaneca aschenborniana* Cockerell.

Remarks. Michener (1954) considered a series of specimens from Costa Rica determined by Friese as *Tetralonia costaricensis* Friese as probably being of this species (or *M. panamensis* Cockerell, since Michener had a series of the two species, *tepaneca* and *panamensis,* mixed) with the metasomal bands gone because of rubbing or greasing. However, it can be definitely stated that *costaricensis* is not a synonym of *tepaneca,* since the former does not belong to the subgenus *Melissodes* according to the original description of the male (black labrum). The types of *costaricensis* should be examined to see whether or not Friese erred in associating the sexes.

Type material. Lectotype female of *tepaneca* from Mexico is in the Academy of Natural Sciences of Philadelphia. Three female paratypes and two male paratypes of *tepaneca* from Mexico are also

in the Academy of Natural Sciences of Philadelphia, but at least one female and both males are not conspecific with the lectotype, but are either *M. thelypodii thelypodii* or *M. thelypodii stulta*. Examination of the male genitalia will clarify this problem. The holotype male of *aschenborniana* from Gualán, Guatemala, on *Vernonia aschenborniana*, W. P. Cockerell, is in the American Museum of Natural History. The holotype female of *aurescens* from Zamorano, Honduras, November 27, 1946, W. P. Cockerell, is in the U. S. National Museum. The female holotype of *bruesi* from Fedor, Texas, May 5, 1902, is the property of the California Academy of Sciences, but on temporary deposit in the collection of the Citrus Experiment Station, Riverside. Lectotype female, here designated, of *galvestonensis* from Galveston, Texas, May, F. H. Snow, is in the Snow Entomological Museum at the University of Kansas. Holotype male of *loena* from Lee Co., Texas, September, 1908, is the property of the California Academy of Sciences, but temporarily deposited in the collection of the Citrus Experiment Station, Riverside. The holotype male of *masuca* from Fedor, Texas, April 17, 1901, is in the University of Colorado Museum. Lectotype female, here designated, of *petalostemonis* from Carlinville, Illinois, August 19, 1898, on *Abutilon avicennae*, Charles A. Robertson (Collection No. 21418) is in the collection of the Illinois Natural History Survey, Urbana.

Distribution. From southern Illinois south through northeastern and south central Kansas, Texas, Mexico and Honduras to Panamá, east in the United States from Texas through the Gulf States to northern Florida and north through the Atlantic States to North Carolina (Fig. 17). This species has been collected throughout the year in various parts of its range as follows: United States: March 23 (in the south) to November 11; Mexico: June 2 to July 26; Costa Rica: June 25; Honduras: November 22 to April 8; Panamá: November 29 to June 17. In addition to the type material, 744 females and 358 males have been examined from the localities listed below. This list includes type localities and localities reported in the literature.

Alabama: Decatur. Arkansas: Lawrence Co.; Marion Co. Florida: Pensacola. Georgia: Adairsville; Brinson; Kennesaw Mountain. Illinois: Carlinville; "Ill." Kansas: Baldwin, Douglas Co.; Dickinson Co.; Meade Co. Louisiana: Dixie; East Point; Mandeville; Opelousas; Rayne; Tallulah. North Carolina: Marion. Texas: Abilene; Austin; Bay City; Baytown; Bexar Co.;

FIG. 17. Map showing the distribution of *M. (Melissodes) tepaneca.*

Brownsville; Cameron Co.; Camp Bullis, Bexar Co.; Christoval; College Station; Concan (8 miles S.); Corpus Christi; Cotula; Cypress Mills, Blanco Co.; Del Rio; Dilley; Eastland Co.; Edna; Fedor, Lee Co.; Fort Sam Houston, Bexar Co.; Fredericksburg; Frio Co.; Galveston; Giddings; Goldthwaite; Goliad; Harper; Hidalgo; Hockley; Hungerford; Kerrville; Laredo; Lee Co.; Llano; Lopeno; Magnolia; Matagorda; Mission (15 miles N. W.); Nueces; Paris; Pecos River; Point Isabel; Progreso; Quemado; Refugio; Robstown; Rock Island; Rockport; Runge; Salado Creek, Bexar Co.; San Angelo; San Antonio; San Benito; San Gabriel River; Santa

Maria; San Ygnacio; Sargent; Sarita; Sonora; Southmost, Cameron Co.; Stonewall; Taylor; Tivoli; Uvalde; Victoria; Willis. Chihuahua: Madera. Distrito Federal: México (city). Guerrero: Mexcala. Hidalgo: Ixmiquilpan. Jalisco: Tequila (8 kilometers W.); Tizapán (10 miles W. and 2 miles E.); Villa Guadalupe. Michoacan: Ciudad Hidalgo (4 miles W.); Jacona (3 miles W.). Morelos: Alpuyeca. Nayarit: Ahuacatlán; San Blas; Tepic (32 miles N. W.). Nuevo Leon: El Cercado (4 miles W.); Vallecillo; Villa de Santiago. Oaxaca: El Camarón; Salina Cruz; Tehuantepec (6 miles S.); Totolápam. Puebla: Acatlán (9 miles N. W.); Atlixco (7 miles S.); Puebla (6 miles S. W.); Tehuacán. San Luis Potosi: El Salto; Pujal (15 miles S.). Tamaulipas: Ciudad Victoria; El Limón; El Limón (22 miles N.); Jiménez (22 miles S.); Llera; Padilla; Padilla (14 miles S.); Villagrán. Veracruz: Martínez de la Torre (9 miles S. W.); Tecolutla. Yucatan: Chichén Itzá. Costa Rica: San José. Guatemala: Gualán. Honduras: Zamorano. Canal Zone: Albrook Field; Ancón Hill; Chiva Chiva Trail; Corozal; Cristóbal; Culebra-Arraiján Trail; Juan Mina. Panama: Camarón; Chame; Chilibre; Chorrera; Matías Hernández; Old Panamá; Pacora; Panamá, city; Pueblo Neuvo.

Flower records. *M. tepaneca* has been collected on the flowers of the plants listed below. This list includes plants recorded in the literature. UNITED STATES: *Abutilon avicennes, A. theophrasti, Agastache braviflora, Asclepias syriaca, A. tuberosa, Aster* sp., *A. tenacetifolium, Baccharis* sp., *Borrichia frutescens, Brazoria truncata, Callirhoe involucrata, Cephalanthus occidentalis, Cercidium* sp., *C. texanum, Coreopsis palmata, Dalea grisea, Eryngium* sp., *E. leavenworthii, Gaillardia* sp., *G. suavis, Gossypium herbaceum, Grindelia* sp., *Helenium* sp., *H. microcephalum, Lactuca pulchella, Lindheimeria texana, Lythrum alatum, L. lanceolatum, Marrubium vulgare, Medicago* sp., *Monarda* sp., *M. punctata, Opuntia* sp., *O. lindheimeri, Parkinsonia* sp., *Petalostemum multiflorium, P. purpureum, P. violaceum, Phacelia* sp., *Phlox* sp., *Prosopis* sp., *Ratibida columnifera pulcherima, Rubus* sp., *Rudbeckia* sp., *Salvia* sp., *Sisyrinchium campestre, Teucrium canadense, Verbesina encelioides, Verbena officinalis, V. stricta.* MEXICO: *Asclepias* sp., *Donnellsmithia hintonii, Eysenhardtia polystachya, Ipomoea longifolia, Lippia* sp., *Sphaeralcea* sp. GUATEMALA: *Vernonia aschenborniana.* HONDURAS: *Ipomoea murucoides, Salvia* sp., *Sida acuta.* PANAMÁ: *Cornuta grandifloria, Cuphea balsamona, Davilla kunthii, Hibiscus tiliaceus, Ipomoea triloba.*

Melissodes (Melissodes) rufodentata Smith.

Melissodes rufodentata Smith, 1854, Catalogue of Hymenopterous Insects in the Collection of the British Museum, part 2, p. 314.

Melissodes trifasciatella Ashmead, 1900, Trans. Ent. Soc. London, p. 210 (new synonymy).

Melissodes rufodentata is a highly variable species from the Leeward Islands in the West Indies. The identity of this species has long been in doubt. Cockerell identified as *rufodentata* a series of males and females collected on St. Vincent, British West Indies, by Mr. J. Ogilvie. The males agree well with Smith's brief description and Dr. I. H. H. Yarrow of the British Museum has compared one of these with the type and considers them to be conspecific.

This species is closely allied to *M. tepaneca* of the mainland. The males have the same type of terminalia, but differ in the following respects: the apical margin of the eighth sternum is straight; the apodemes of the eighth sternum have smoothly rounded posterior margins, not sinuate as in *tepaneca*; the punctures on the vertex of the head, mesoscutum and terga are sparser and less distinct than in *tepaneca*. The paler females are easily separated from those of *tepaneca* by usually not having dark hairs ventrally, anteriorly or laterally on the mesepisterna, by being less conspicuously punctate and by the sharp contrast between the orange mesoscutal hairs and the white mesepisternal hairs. The dark females can be distinguished by the presence of brown hairs on the posterior pronotal lobes and face and by the sparser punctation.

Female. Measurements and ratios: N, 9; length, 10-11 mm.; width, 4 mm.; wing length, $M = 3.43 \pm 0.188$ mm.; hooks in hamulus, $M = 14.89 \pm 0.275$; flagellar segment 1/segment 2, $M = 1.85 \pm 0.044$.

Structure and color: Integument black except as follows: distitarsi and usually hind basitarsi and tibiae red, remainder of legs often dark brownish-red; apical half or more of mandibles with longitudinal median golden maculae; antennal scapes and first two flagellar segments black to dark brown, remaining segments dark red below, black above, occasionally all dark brown to black; apical area of tergum 1 often reddish-brown; eyes gray to grayish-green; wing membranes clear to slightly infumate, veins dark brown to black; tegulae testaceous. Structure and punctation as in *tepaneca* with the following differences: lateral flattened areas of vertex usually with smaller, sparser punctures, ground usually smooth and shiny; mesoscutum without posterior area of crowded punctures, or this area restricted to the short declivous area and punc-

tures not noticeably smaller than in posteromedian area, punctures on mesoscutum more evenly distributed, separated by one half to two puncture widths, slightly sparser in posteromedian area; mesepisterna with ground areas often dulled by fine irregular shagreening; tergum 2 with punctures of interband zone sparser, separated by two to three puncture widths medially, small and round; apical areas of terga 2 and 3 with minute punctures, no wider than twice basal diameter of hairs arising from them, separated by one to four puncture widths.

Hair: pale specimens with characters of vestiture of *tepaneca* with the following differences: vertex of head with abundant dark brown hairs, often extending onto upper part of face and laterally to the level of antennal fossae or more; mesoscutum occasionally with a small posteromedian area of brown hairs; mesoscutal and scutellar hairs usually orange or orange-red; hairs of lateral surfaces of thorax white, except pale ferruginous in extreme upper portion near wing bases; posterior lobes of pronotum often with long brown hairs mixed with the pale; legs with less brown hairs, white except as follows: dark to pale brown on outer surfaces of fore and middle tarsi and tibiae, dark brown on and surrounding basitibial plates, yellow to orange on inner surfaces of hind basitarsi and tibiae, rufescent on inner surfaces of fore and middle basitarsi.

The darkest specimens with hairs of the head entirely dark brown except pale ochraceous to white hairs on lower two thirds of genal areas and often about one fifth of hairs of face (especially surrounding antennal fossae) white; hairs of thorax dark brown to black except as follows: posterior pronotal lobes with white tomentum along margins, lower posterior third or less of mesepisterna, at least lower third of metepisternum and propodeum with white to pale ochraceous hairs, propodeal hairs often brown on lower anterior part of lateral face; metasomal terga with hairs and pubescence all brown except usually long pale hairs on basal third of tergum 1, distal pale band of tergum 2 (although this often narrowly interrupted medially), terga 3 and 4 with pubescent bands pale to dark brown; hairs of hind legs as in typical pale specimens, hairs of fore and middle legs dark brown except rufescent hairs of inner surfaces of tarsi.

A single intermediate specimen has a large square mesoscutal dark brown hair patch, abundant scutellar and posterior pronotal dark hairs, dark hairs on lower lateral, ventral and anterior surfaces of mesepisterna, and the facial hairs approximately half dark and half white.

Male. Measurements and ratios: N, 13; length, 9-10 mm.; width, 2.0-3.5 mm.; wing length, M = 3.12 ± 0.378 mm.; hooks in hamulus, M = 13.15 ± 0.191; flagellar segment 2/segment 1, M = 8.47 ± 0.059.

Structure and color: Color as in *tepaneca* but legs with at least tarsi orange-red and often legs entirely red. Structure and sculpturing as in *tepaneca* except as follows: mesoscutum never with small posteromedian area of crowded punctures, punctures evenly distributed or with posteromedian flattened area sparsely punctate; interband zone of tergum 2 with smaller, more widely spaced punctures than in most individuals of *tepaneca;* apical areas of terga 2 to 5 impunctate or with punctures no wider than twice basal diameter of hairs arising from them.

Genitalia and hidden sterna as in *tepaneca* with the following differences: gonostyli with tufts of simple hairs on outer lower surfaces shorter and hairs more abundant; sternum 8 with straight apical margin, with very few, minute apical hairs, with longitudinal ventral carina extending beyond apex of sternum by about half of its own length, with lateral apodemes smoothly rounded posteriorly (Figs. 88-89).

Hair: With vestiture of *tepaneca,* but often with several to many long brown hairs on vertex of head and occasionally a few dark hairs on mesoscutum and scutellum.

Remarks. Ashmead named *trifasciatella* from melanistic females from St. Vincent, British West Indies. Among the females of *rufodentata* collected on St. Vincent by Mr. J. Ogilvie are two which are darker than the typical *rufodentata* and one of these is almost precisely half way between the palest and the darkest specimens studied. The paratype of *trifasciatella,* presumably collected with the holotype, is the darkest specimen examined and is considerably darker than the holotype. Another of the females collected by Mr. Ogilvie is almost identical with the holotype of *trifasciatella,* but is slightly paler. In view of these facts, and the additional fact that the punctational and structural characters of the holotype and paratype of *trifasciatella* are identical to those of the typical female of *rufodentata,* there is no reason to consider these as distinct species. That they might be subspecies seems contradicted by the fact that they are both found on the same, relatively small, island—St. Vincent. Additional material with more precise locality information might clarify the situation further.

C. D. Michener (1954) provisionally identified a single female

from Cerro Cobre, Panamá, as *trifasciatella*. This female is badly worn and identification is uncertain. The coloration of the vestiture is similar to that of the dark *rufodentata* females. However, it is definitely not this species, as is shown by the very short clypeus, the dark hairs of the inner surfaces of the hind basitarsi and by the shiny, impunctate triangle of the declivous face of the propodeum. Perhaps it represents a new species, but is in such poor condition that a description does not appear justified until more material becomes available. One cannot be certain that it belongs to the subgenus *Melissodes*, because of destruction of characters of the vestiture.

Type material. Holotype male of *rufodentata* from St. Vincent, British West Indies, is in the British Museum (Natural History). Holotype female of *trifasciatella* from St. Vincent, B. W. I., collected by H. H. Smith, is in the U. S. National Museum (U. S. N. M. Type No. 6396).

Distribution. The Leeward Islands, West Indies, from Grenada in the south to Dominica in the north. The following specimens have been examined (including the type material of *trifasciatella*).

Dominica: Roseau, 2 males, June 9, 1911. Grenada: 2 females, September 15, 1921, A. Busck; St. John's River, 1 male, H. H. Smith. St. Vincent: 2 males, 2 females (holotype, paratype of *trifasciatella*), H. H. Smith; 1 female, April 4, J. Ogilvie; 1 male, 1 female, April 5, J. Ogilvie; 2 females, 2 males, September 4, 1938, J. Ogilvie. One female and one male with no data.

Melissodes (Melissodes) gilensis Cockerell.

This species is closely related to *M. communis* and is difficult to distinguish from *M. communis alopex*. The males are easily recognized by the median plates of the eighth sternum which are similar to those of *communis* but flattened, enlarged and with the tips bent dorsally. The males can be recognized by the following external characters: the apical areas of the terga are hyaline and usually yellow; the punctation and flagellar segments are as in *communis;* the mesoscutum and scutellum always have patches of dark brown hairs and the tegulae usually have dark hairs; the distal pale band of tergum 2 is broad as in *alopex*; the apical areas of the terga are less densely shagreened than in *communis*. The females can be distinguished from those of *communis* as follows: the distal pale band of tergum 2 is broad as in *alopex;* the posterior pronotal lobes usually have at least one dark hair and often more mixed

with the pale; the narrow anterior half of each tegula almost always has at least one and usually several moderately long, erect, black hairs mixed with the pale. Both sexes usually have the pale hairs of the head and thorax white or pale ochraceous and the pale metasomal pubescence yellow or ochraceous, especially on terga 3 and 4. This is best expressed in the female, but is obvious in fresh, unworn males.

Female. Measurements and ratios: N, 20; length, 11-14 mm.; width, 4.0-5.5 mm.; wing length, M = 4.55 ± 0.277 mm.; hooks in hamulus, M = 16.00 ± 0.205; flagellar segment 1/segment 2, M = 1.88 ± 0.017.

Structure and color: Integument black except as follows: tarsi dark red; tibiae and femora often dark red; apical halves of mandibles dark red; flagella red beneath except first two segments, black above; tergum 1 with narrow hyaline yellow margin; terga 2 and 3 with apical areas dark reddish-brown; sterna dark red; eyes gray to yellowish-green; wing membranes slightly infumate, brownish, veins dark reddish-brown. Maxillary palpal segments in ratio of about 3:4:2:1.5, third segment often slightly longer; structural characters of head, thorax and metasoma of *communis* with the following differences: clypeus with punctures slightly sparser posteriorly, ground usually more densely tessellate, boss or median carina usually less well defined; mesoscutal punctures smaller; mesepisterna with ground areas usually delicately shagreened.

Hair: On head white or pale ochraceous except abundant black hairs on vertex between apices of compound eyes and extending onto face below median ocellus. Hairs of thorax white to pale ochraceous except as follows: mesoscutum with large patch of black hairs extending forward to a transverse line at anterior margins of tegulae or more; tegulae usually with brown appressed hairs on posterior halves (often rubbed off) and almost always with at least one or two and usually several long black hairs mixed with the white on narrow anterior halves; posterior pronotal lobes almost always with at least one and usually many long black hairs mixed with the pale. Metasomal vestiture as in *communis* with the following differences: pale hairs and pubescence ochraceous to yellow, band on terga 2-4 become progressively more yellow distally in unfaded specimens, concolorous and ochraceous in faded specimens; distal band of tergum 2 usually as wide as apical area medially or wider, occasionally slightly narrower but always wider than half of apical area and at least as wide as inter-

band zone; pale pubescent bands of terga 3 and 4 broader than in *communis,* usually more than twice as broad as distal band of tergum 2 medially; apical areas of terga 2 and 3 with abundant subercct to erect hairs; tergum 5 with tufts of ochraceous hairs laterally but these absent on tergum 6; sternal hairs dark red to yellow medially, ochraceous laterally. Legs with pale ochraceous to white hairs except as follows: outer surfaces of fore tarsi, apically on outer surfaces of fore and middle tibiae and on basitibial plates brown; inner surfaces of tarsi and hind tibiae red to yellow.

Male. Measurements and ratios: N, 20; length, 10-13 mm.; width, 3.0-4.5 mm.; wing length, M = 4.35 ± 0.358 mm.; hooks in hamulus, M = 14.90 ± 0.216; flagellar segment 2/segment 1, M = 5.03 ± 0.116.

Structure and color: Integument black except as follows: labrum white; clypeus and large triangular spots at bases of mandibles yellow; tarsi and hind tibiae red; fore and middle tibiae and femora often dark reddish-brown; apical areas of metasomal terga hyaline, yellow; flagella yellow to red beneath, except first segment and extreme base of second segment, dark brown to black above; eyes usually green, occasionally gray or brown; wing membranes slightly infumate, brown, veins dark reddish-brown to black. Maxillary palpi as in female; minimum length of first flagellar segment equals about one fifth of maximum length of second segment, occasionally more, rarely less and never less than one sixth of second; other structural characters as in *communis* with the following differences: mesoscutal punctures usually smaller; mesepisternal ground areas usually dulled by fine shagreening; metasomal terga 2-5 with apical areas dulled by fine shagreening, but usually less so than in *communis s. str.* and distinctly less than in *communis alopex.*

Genitalia and hidden sterna as in *communis* except as follows: spatha with apical margin sinuate; sternum 7 with median plates expanded and flattened, medially as wide as lateral plates at same level, apical oblique margin curved outwards, apical fifth or sixth bent sharply dorsally, with median carinae forming a broad V-shaped structure, with apodemes slender and truncate (Figs. 93-95).

Hair: Vestiture as in female with the following differences: pale hairs of head and thorax white to ochraceous, more often ochraceous than in female; vertex often with less black hairs than in female; tegulae often without dark hairs (about 50 per cent of specimens); posterior pronotal lobes often without dark hairs; mesoscutal patch of dark hairs often not extending forward to level

of anterior margins of tegulae, but always present; pale hairs and pubescence of metasoma usually more yellow than in female, especially on terga 4 and 5, in fresh specimens; tergum 5 with a complete apical pale pubescent band as broad as that on tergum 4 or almost so; sternal hairs yellow medially, pale ochraceous laterally. Legs with white to pale ochraceous hairs except orange to yellow hairs on inner surfaces of tarsi and tibiae and brown hairs on basitibial plates.

Bionomics. *M. gilensis* is seemingly restricted to moderately high altitudes in arid or semiarid regions of the southwest. Most of the specimens examined are from localities which range in general altitude upwards from 4000 feet. A single specimen from Dublin, Texas, is the only exception to this. Those specimens bearing altitude data on the labels all show altitudes above 5000 feet. Furthermore, the only localities where this species has been taken in abundance are areas of rough terrain with many mountains and canyons. This has left notable gaps in the collection data. For instance, a large area between Nogal, New Mexico, and Jeff Davis County, Texas, where high plains dominate the physiography, has thus far yielded no specimens of *M. gilensis*. Perhaps, this species occurs in this region in such limited areas as the Guadelupe Mountains in New Mexico and Texas and the Delaware Mountains of Texas. The single male from Dublin, Texas, may perhaps be explained by the rough terrain of the escarpment of the Edwards Plateau in central Texas. This region should be collected more thoroughly in the future.

Little is known concerning the flower preferences of *gilensis*. According to the existing evidence, it is a polylectic species as are most members of this subgenus.

Geographical variation. This species is divisible into two subspecies, a paler race from Arizona, New Mexico and Colorado (*gilensis s. str.*) and a darker Mexican race (*crenata*). The specimens from southwestern Texas are intermediate between the two races in color. However, too few specimens are available to be able to describe the zone of intergradation in detail. Four males from the state of Chihuahua, Mexico, are also considered as from the zone of intergradation, although this is only tentative until series of females from this region can be studied. Two of these males from Santa Barbara in southern Chihuahua are much darker than the two from central Chihuahua and the former may be found to mark the northern limit of the subspecies *crenata*. A single male from

Fresnillo, Zacatecas, is as pale as the Santa Barbara males, but is within the range of *crenata*. Three females from the state of Durango and one from the state of Nuevo León are all typical specimens of *crenata*.

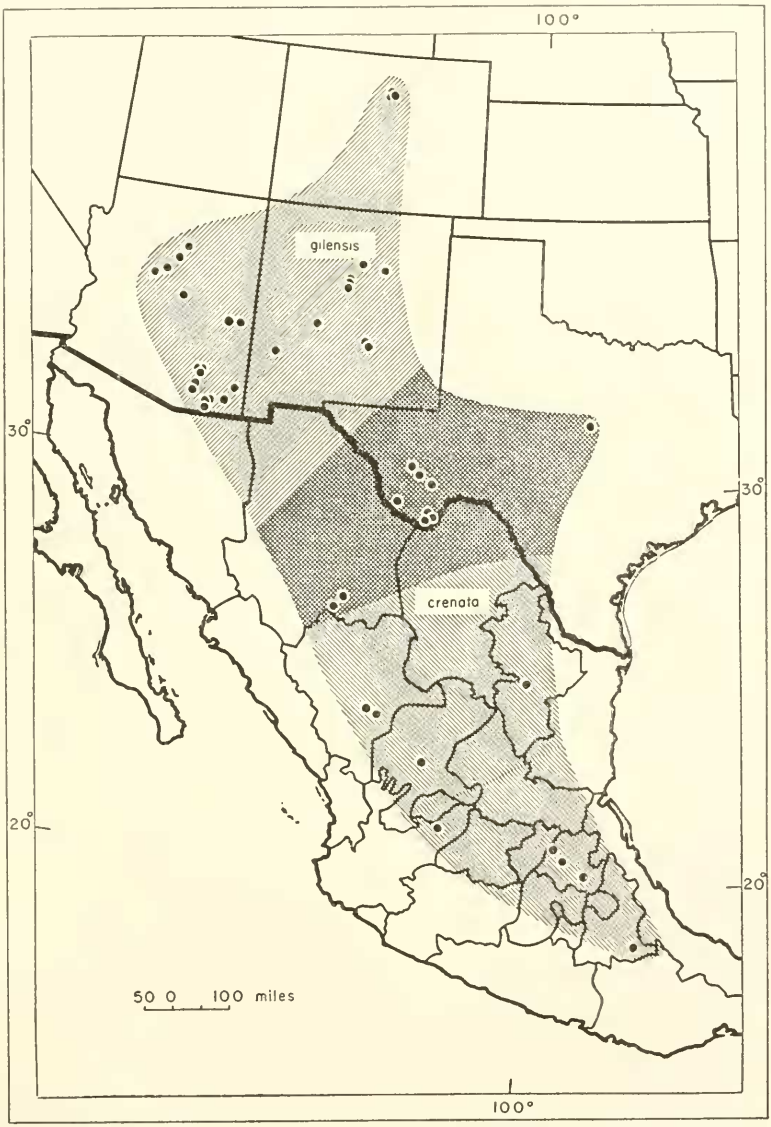

FIG. 18. Map showing the distribution of *M. (Melissodes) gilensis*. The overlapping type of shading indicates the zone of intergradation between the two subspecies.

TABLE VI.—Percentages of females of *Melissodes gilensis* exhibiting certain characters of vestiture.

Characters		Arizona (96)	New Mexico (23)	Texas (10)	Mexico (22)
Number of black hairs on the posterior lobes of the pronotum.	0	18.8	13.0	0	0
	1–10	47.9	47.8	0	0
	11–20	15.6	13.0	10.0	0
	21–30	8.3	21.7	40.0	4.5
	31–40	6.3	4.3	30.0	31.8
	41–50	1.0	0	10.0	14.4
	51–60	2.1	0	10.0	14.4
	61–70	0	0	0	22.7
	71–80	0	0	0	4.5
	81–90	0	0	0	4.5
With black hairs medially on tergum 4.		4.2	4.3	*100.0	†100.0
With black hairs on anterior part of tegulae.		95.8	91.7	100.0	100.0
Apical area of tergum 3 with hairs yellow or mostly so.		52.1	52.2	*0	0
Distal pale band of tergum 2 equal to apical area or wider.		69.8	69.6	*20.0	4.3

*Only 5 females in condition for use of metasomal characters.
† Only 16 females with distal band not badly worn.

Table VI illustrates the situation for some of the characters important in separating these two subspecies. The figures are percentages of females which bear the indicated character. The

Texas specimens are seen to be almost perfectly intermediate in regard to the number of dark hairs on the posterior pronotal lobes and the width of the distal pale band of tergum 2, but are more like the Mexican specimens in regard to the remaining characters. This last fact may be due to the small sample involved. The Texas females available are mostly in very poor condition and metasomal characters in five of the ten usable females (out of thirteen available) are not decipherable.

Melissodes (Melissodes) gilensis gilensis Cockerell.

Melissodes gilensis Cockerell, 1896, Entomologist, vol. 29, p. 306; 1898, Bull. Sci. Lab. Denison Univ., vol. 11, p. 67; 1898, Bull. Univ. New Mexico, vol. 1, p. 67; 1901, Ent. News, vol. 12, p. 40; 1906, Trans. Amer. Ent. Soc., vol. 32, pp. 87, 92; Snow, 1906, Trans. Kansas Acad. Sci., vol. 20, p. 137; Cockerell, 1926, Univ. Colorado Studies, vol. 16, p. 114.

Melissodes epicharina Cockerell, 1905, Psyche, vol. 12, p. 99 (new synonymy); 1906, Trans. Amer. Ent. Soc., vol. 32, pp. 83, 87; Snow, 1906, Trans. Kansas Acad. Sci., vol. 20, p. 137.

This subspecies can be separated from *M. gilensis crenata* by the paler color as described below. The tabulation (Table VI) gives additional information regarding the value of the most diagnostic characters of the female in terms of percentages of females from each region bearing the particular characters. The males are more difficult to separate than the females because of their greater variability. However, a majority of males of *gilensis s. str.* can be distinguished by the use of two characters—the yellow hairs of the apical areas of the terga and the lack of brown hairs mixed with the pale on the posterior pronotal lobes.

Female. Structure and color; metasomal tergum 1 usually hyaline in apical sixth; apices of terga 2 and 3 usually reddish-brown; supraclypeal area with several large round punctures medially in about 40 per cent of the specimens.

Hair: Pale hairs of head and thorax usually white but often pale ochraceous; mesoscutal patch of dark hairs usually reaches transverse line at anterior margins of tegulae, rarely larger, occasionally extending laterally in front of tegulae near anterior margin; posterior pronotal lobes usually with 1 to 30 long black hairs mixed with the pale, occasionally with more than 30, rarely with none; anterior narrow halves of tegulae usually with at least one moderately long black hair mixed with the pale and often several; apical area of tergum 3 and often of tergum 2 usually with suberect yellow hairs, these becoming dark brown medially and often entirely dark brown; tergum 4 usually without dark brown or black hairs

medially near apex, or with only 1 or 2 dark hairs, suberect, relatively simple hairs usually present in this area.

Male. Structure and color: Supraclypeal area with several large round punctures medially in half or less of the specimens.

Hair: Vertex between compound eyes usually without black hairs; mesoscutal patch of dark brown hairs usually not extending forward to a transverse line at anterior margins of tegulae, usually square or almost so; posterior lobes of pronotum without dark hairs mixed with the pale; tegulae often without dark hairs mixed with the pale anteriorly; metasomal tergum 2 with distal pale band usually as wide as or broader than apical area medially, with interband zone usually with long, erect or suberect, relatively simple, yellow to pale ochraceous hairs, occasionally these partly dark brown at least medially; apical areas of terga 2-4 with long, subappressed to suberect, relatively simple, yellow hairs, rarely brownish on tergum 2; tergum 5 without dark brown hairs medially at apex; terga 3-5 usually without dark brown hairs at extreme bases.

Remarks. Cockerell (1905) described a female from Oak Creek Canyon, Arizona, as *Melissodes epicharina.* This female has the basal pale band of tergum 2 worn away, but vestiges remain at the extreme sides of the tergum and the punctation across the tergum is evidence of the former presence of this band. As far as is known at present, no *Melissodes* lacks the pale pubescent band at the base of tergum 2 except certain melanistic species in which this band becomes dark brown—but the pubescence is still present. Also, the basal pale band may become fused with the distal band in some species, so that there appears to be only one broad band present, but even in these species, the basal band can be distinguished by the form of the hairs as contrasted with those of the distal band.

Type material. The type specimen of *gilensis* either was never designated or was lost. Cockerell did not designate a type specimen in the original description. Of the type series of eight females and one male, only six females and the one male have been located. These are as follows: two females from the West Fork of the Gila River, New Mexico, August 12 and 16, C. H. T. Townsend, are in the U. S. National Museum (U. S. N. M. cotype No. 3358); one female with the same data, collected on August 16, is in the Snow Entomological Museum at the University of Kansas and is labeled topotype; one female with the same data, collected on August 16, is in the collection of the California Academy of

Science, San Francisco; one female and one male with the same data, collected on August 16, and one female from La Tenaja, New Mexico, by M. Boyle are in the Colorado Museum of Natural History at Boulder. The male fits Cockerell's description perfectly, but, unfortunately, does not belong to the same species as the females from the same locality. It is probably *M. montana* Cresson. In view of the fact that Cockerell in his earlier descriptions of bees often did not select type specimens from a series, this is assumed to have occurred in the case of *M. gilensis* and the female collected by C. H. T. Townsend from the West Fork of the Gila River and deposited in the collection of the University of Colorado Museum is hereby designated as the lectotype. The holotype female of *epicharina* from Oak Creek Canyon, Arizona, July, 6000 feet altitude, F. H. Snow, is in the Snow Entomological Museum at the University of Kansas.

Distribution. Southeastern Arizona, New Mexico and eastern Colorado (Fig. 18). This subspecies has been collected from April 19 through September 27. From the localities listed below, 228 females and 113 males have been examined. This list includes localities reported in the literature.

Arizona: Apache Camp, Santa Catalina Mts.; Carr Canyon, Huachuca Mts.; Chiricahua Mts.; Cochise Co.; Flagstaff (Walnut Canyon); Fort Grant, Pinaleno Mts.; Graham Mts.; Jerome (4 miles S.); Madera Canyon, Santa Rita Mts.; Mud Springs, Santa Catalina Mts.; Oak Creek Canyon, near Flagstaff; Palmerlee; Prescott; Ramsey Canyon, Huachuca Mts.; Sabino Basin, Santa Catalina Mts.; Santa Rita Mts.; Sycamore Forest Camp (7 miles N. of Payson, Gila Co.); White Mts.; Whiteriver. Colorado: Boulder; Jim Creek, near Boulder; Jim Creek (left hand junction), Boulder Co. New Mexico: Cedro Canyon, Bernalillo Co.; Cienega Canyon, Sandia Mts.; Dripping Springs; La Tenaja; Las Vegas; Magdalena Mts.; Nogal; Rio Ruidoso, White Mts.; Sandia Mts.; Santa Fe; West Fork Gila River. Texas: * Alpine (20 miles S.); * Big Bend, Brewster Co.; * Big Bend National Park; * Chinati Mountain; * Chisos Mts.; * Davis Mts.; * Dublan; * Marathon. Chihuahua: * Primavera; * Santa Barbara.

Flower records. Arabis sp., *Asclepias tuberosa, Cirsidium torreyana, Cirsium* sp., *Lippia lyciddea, Lotus* sp., *L. brightii, Lupinus* sp., *Malva* sp., *Melilotus alba, M. officinalis, Monarda* sp., *M. menthaefolia, M. stricta, Nolina* sp., *Robinia neomexicana.*

* Localities from the zone of intergradation.

Melissodes (Melissodes) gilensis crenata, subsp. nov.

This subspecies can be distinguished from *gilensis s. str.* by the characters listed in the diagnosis of the latter.

Female. Structure and color: First tergum usually extremely narrowly hyaline apically, less than apical sixth hyaline; apices of terga 2 and 3 usually dark brown to black; supraclypeal area usually with several coarse punctures medially.

Hair: Pale hairs of head and thorax usually white or almost so; mesoscutal patch of dark hairs usually extends forward beyond a transverse line at anterior margins of tegulae and usually extends laterally at anterior margin in front of tegulae, occasionally fusing with dark hairs of posterior pronotal lobes; posterior pronotal lobes usually with more than 30 long black or dark brown hairs mixed with the pale, occasionally less, but not with less than 21 dark hairs in the specimens examined; tegulae always with dark hairs mixed with the pale anteriorly; metasomal tergum 2 with distal pale band usually narrower than apical area medially, occasionally as wide as apical areas, but no wider in any specimens examined; apical areas of terga 2 and 3 with dark brown hairs; tergum 4 with at least a few black or dark brown suberect hairs medially near apex.

Male. Structure and color: Supraclypeal area usually with several coarse punctures medially.

Hair: Vertex between apices of compound eyes usually with at least a few dark brown hairs; mesoscutal patch of dark hairs usually extending forward to or beyond a transverse line at anterior margins of tegulae and often extending laterally at anterior margin so as to be inversely trapezoidal in outline; posterior lobes of pronotum usually with at least one or two long dark hairs mixed with the pale; tegulae always with at least a few dark hairs anteriorly; metasomal tergum 2 with distal pale band often slightly narrower than apical area medially, with interband zone always with dark hairs at least medially; apical areas of terga 3 and 4 always with dark brown hairs at least medially; tergum 5 often with an apical patch of suberect dark brown hairs medially near apex.

Type material. Holotype male, allotype female, four female and one male paratype from 3 miles west of Pachuca, Hidalgo, Mexico, June 24, 1953, on *Opuntia* sp., Univ. of Kansas Mexican Expedition. Fifteen female and ten male paratypes from Mexico as follows: DURANGO: Durango, 1 female, August 14, 1947, 6200 feet, W.

Gertsch; Nombre de Dios (10 kilometers N.), 1 female, August 5, 1951, H. E. Evans. Hidalgo: Ixmiquilpan, 4 males, June 23, 1953, 5300 feet, Univ. of Kansas Mexican Expedition; Pachuca (3 miles W.), 1 female, June 24, 1953, on *Argemone* sp., Univ. of Kansas Mexican Expedition; Zimapán, 7 females and 2 males, June 11-14, 1951, on *Eysenhardtia polystachya*, P. D. Hurd; 2 females, June 11, 1951, H. E. Evans. Jalisco: Encarnación de Diaz, 1 female and 1 male, July 28, 1951, P. D. Hurd. Nuevo León: El Cercado (4 miles W.), 1 female, June 6, 1951, P. D. Hurd. Puebla: Tehuacán, 1 female, June 23, 1951, H. E. Evans. Zacatecas: Fresnillo, 1 male, August 15, 1947, 7000 feet, C. D. Michener (Fig. 18). The holotype and allotype are in the Snow Entomological Museum at the University of Kansas. Paratypes are in the collections of the Snow Entomological Museum, the California Academy of Science, the University of California, the American Museum of Natural History and in the author's collection.

Melissodes (Melissodes) paroselae Cockerell.

Melissodes humilior, Cockerell, 1903, Ann. Mag. Nat. Hist., ser. 7, vol. 12, p. 447 (*humilior*, var. a).
Melissodes parosetae (*sic*) Cockerell, 1905, Ann. Mag. Nat. Hist., ser. 7, vol. 15, p. 528; 1906, Trans. Amer. Ent. Soc., vol. 32, p. 78.
Melissodes paroselae Cockerell, 1905, Ann. Mag. Nat. Hist., ser. 7, vol. 16, p. 477 (emendation of *parosetae*); 1906, Trans. Amer. Ent. Soc., vol. 32, p. 310; 1925, Ann. Mag. Nat. Hist., ser. 9, vol. 16, p. 229.
Melissodes helenae Cockerell, 1906, Ann. Mag. Nat. Hist., ser. 7, vol. 17, p. 365 (new synonymy); 1906, Trans. Amer. Ent. Soc., vol. 32, p. 310
Melissodes communis gratior Cockerell, 1923, Proc. California Acad. Sci., vol. 12, p. 85 (new synonymy).

This is a distinctive small bee from the southwestern United States and northern Mexico. Both sexes can be distinguished as follows: the punctation of the mesoscutum and metasomal terga is much as in *communis*; the basal pale band of tergum 2 consists of plumose and spatuloplumose hairs mixed; the hairs of the mesoscutum are usually appressed. In addition, the male has short first flagellar segments and distinctive terminalia as described below, and the female has pale red to yellow hairs on the inner surfaces of the hind basitarsi.

Female. Measurements and ratios: N, 20; length, 9-12 mm.; width, 3.5-5.0 mm.; wing length, $M = 3.61 \pm 0.194$ mm.; hooks in hamulus, $M = 12.95 \pm 0.135$; flagellar segment 1/segment 2, $M = 1.77 \pm 0.030$.

Structure and color: Integument black except as follows: distitarsi rufescent and often legs entirely dark red; basal sterna and

apical area of first tergum often reddish-brown; mandibles dark red with large median longitudinal maculae over distal halves; eyes usually gray, occasionally yellowish-green; antennal scapes and first flagellar segment black, second flagellar segment black but often red below in apical half, remaining segments red below and black above; wing membranes clear or slightly milky, not infumate, veins dark red to reddish-brown; tegulae testaceous to reddish-brown. Clypeus coarsely punctate, punctures round, separated by half of one puncture width or less, smaller and more crowded anteriorly, with an irregular median carina, ground areas shiny or moderately so, delicately shagreened; supraclypeal area with abundant punctures at least laterally, ground area medially dulled by fine dense tessellation; vertex of head with flattened lateral areas with minute punctures separated mostly by three or more puncture widths, virtually impunctate, ground areas smooth and shiny or with delicate shagreening; eyes in facial view much broader than one third of length and distinctly longer than facial width between upper apices of eyes; maxillary palpal segments in ratio of about 3:2:1:0.75, third segment often as long as second and fourth often as long as half of second. Mesoscutum with round punctures anteriorly and laterally separated by one half to one puncture width, in posteromedian area larger and separated by one to four puncture widths, often posteromedian area impunctate or with sparse punctures along midline forming two lateral oval impunctate areas, ground smooth and shiny or with delicate shagreening; scutellum with punctures about equal in size to those on anterior half of mesoscutum, separated mostly by less than one puncture width, ground areas smooth and shiny; mesepisterna sculptured much as anterior half of mesoscutum but punctures usually slightly larger; propodeum with distinct punctures on dorsal face apically, becoming reticulopunctate basally, with distinct punctures separated mostly by one puncture width or more on declivous and lateral faces, except impunctate inverted triangle on upper part of declivous face, ground areas opaque, dulled by dense tessellation, but occasionally shiny or moderately so on dorsal face. First metasomal tergum with small, shallow, round punctures in basal half to three fifths, punctures separated by two to three puncture widths, more crowded at extreme base and laterally but still separated by one puncture width, apical area impunctate, ground areas dulled by fine dense shagreening; tergum 2 with punctures of interband zone small, round, separated mostly by two

to three puncture widths, slightly more crowded laterally, apical area impunctate, ground areas dulled by fine, dense shagreening; tergum 3 similar to tergum 2 but basal area (beneath diffuse part of broad pale pubescent band) with punctures more crowded.

Hair: On face, genal areas and occiput white, on vertex pale hairs often rufescent and black or dark brown hairs abundant. Hairs of mesoscutum relatively short and recumbent in at least anterior half; mesoscutum with large posteromedian, square patch of dark brown to black hairs extending forward to a transverse line at about middle of tegulae, often more restricted, pale hairs at least anteriorly usually ochraceous to red, fading through yellow to pale ochraceous; tegulae occasionally with brown hairs; scutellum with large median patch of dark brown hairs fringed with white or pale ochraceous hairs; propodeum and lateral surfaces of thorax with white hairs, occasionally ochraceous on dorsum of propodeum and somewhat rufescent or ochraceous on upper portion of mesepisterna near wing bases. Metasoma with banding as in *communis* but distal pale band of tergum 2 usually broader, often as wide as half of apical area medially and rarely as broad as apical area; basal pale band of tergum 2 consists of plumose and spatuloplumose hairs mixed in ratio of about 1:1; tergum 4 with median oval area of simple dark hairs interrupting broad apical white band; pale pubescence and hairs of metasoma pale ochraceous to white; sternal hairs dark brown to dark red medially, yellow apically and white laterally on each sternum except apical one or two sterna which have all brown hairs. Legs with white hairs except as follows: outer surfaces of fore tarsi, outer surfaces of middle tibiae near apices, and on and surrounding basitibial plates brown; inner surfaces of tarsi and hind tibiae yellow to orange-red; scopal hairs white.

Male. Measurements and ratios: N, 20; length, 8-11 mm.; width, 2-4 mm.; wing length, $M = 3.44 \pm 0.656$ mm.; hooks in hamulus, $M = 11.90 \pm 0.536$; flagellar segment 2/segment 1, $M = 9.19 \pm 0.090$.

Structure and color: Color as in female with the following differences: clypeus and bases of mandibles yellow; labrum completely white or cream-colored; apical areas of terga 2-5 usually dark reddish-brown to dark red, first tergum narrowly hyaline; flagella yellow to red below, black above. Maxillary palpi and sculpturing of head as in female but clypeal punctation obscure; minimum length of first flagellar segment scarcely longer than

pedicle, if at all, equal to one eighth or less of maximum length of second segment. Sculpturing of thorax and metasoma as in female with the following differences: mesoscutum with punctures often more crowded and relatively impunctate posteromedian area often much reduced in size; dorsal face of propodeum often with ground areas smooth and shiny; tergum 2 with punctures of interband zone often somewhat more crowded.

Genitalia much as in *communis*. Sternum 8 with greatly expanded, flattened, median plates, each plate is longer than broad, more than twice as wide as apical third of lateral plate, superficially resembles large membranous plate of members of the subgenus *Eumelissodes*, but shape definitely derivable from the curved, scroll-like plate of *M. communis* and without hairs on ventral surface; lateral plates long, abruptly narrowed near middle and apical portion about half as wide as median plates or narrower; apodemes short, thin, not truncate or capitate; median ventral carinae form a broad, V-shaped structure, well separated from apical margin of sternum. Sternum 9 not emarginate medially at apex, but evenly rounded or slightly pointed; ventral longitudinal carina simple, reaches or slightly exceeds apical margin of sternum; apex with several short, simple hairs on each side of carina (Figs. 98-100).

Hair: As in female with the following differences: vertex of head often without dark hairs but usually with rufescent hairs; mesoscutal patch of dark hairs often restricted or absent; tegulae usually with abundant brown hairs; scutellar patch of brown hairs often restricted but never completely absent; apical areas of terga 1-4 often with some yellow simple hairs mixed with the black, especially along apical margin of tergum 1; tergum 2 with distal band usually broader than in female; tergum 5 with a complete apical pale band; legs with white hairs except yellow to red on inner surfaces of tarsi and hind tibiae, occasionally with a streak of brown on outer surfaces of upper halves of hind tibiae.

Bionomics. Like most members of the subgenus *Melissodes*, this species is highly polylectic. A peculiar feature of this species is the apparent preponderance of males over females. This is probably due to the fact that the females are rather swift fliers and are not easily captured. This unequal sex ratio, which is the reverse of the ratio in most other species, may be attributed also to the fact that the males will congregate in large numbers at the flowers of certain plants which seemingly are good honey sources (judging from the large number of other wasps and flies

on these plants at the same time). The males are easily collected in large numbers while thus congregating, whereas the females do not behave in this manner. The author, together with R. H. and L. D. Beamer and Cheng Liang, observed males congregating on *Cleome luteum*, *Dasylirion wheeleri* and *Eriogonum trichopes* in Arizona in mid-July of 1952. In one locality 170 males were collected within a very few minutes on *Cleome*, while only a single female was taken. In another locality 30 males were taken on *Dasylirion* and only five females.

The rather small total number of collections with flower data, together with the unequal sex ratio, does not permit analysis of preferences such as has been performed for other species. The only conclusion that can be drawn at this time is that *paroselae* seems to be polylectic and visits many composites, as well as other families, for pollen and nectar.

Type material. Holotype male of *paroselae* from Mesilla, New Mexico, July 25, on *Parosela scoparia*, T. D. A. Cockerell, is the property of the California Academy of Sciences, but is temporarily deposited in the collection of the Citrus Experiment Station, Riverside. Female holotype of *gratior* from Guaymas, Sonora, Mexico, April 11, 1921, E. P. Van Duzee, is in the California Academy of Sciences, San Francisco. Holotype female of *helenae* from Las Cruces, New Mexico, August 19, C. H. T. Townsend, is in the collection of the University of Colorado Museum, Boulder.

Distribution. From Baja California to extreme southern California, east across Arizona and New Mexico to extreme southwestern Texas and south through Sonora and Chihuahua to Tepic, Nayarit, in Mexico (Fig. 19). This species has been taken from April 7 to October 20. In addition to the type material, 254 females and 952 males have been examined from the localities listed below (including localities reported in the literature).

Arizona: Apache Co.; Arivaca; Atascosa Mts.; Baboquivari Mts.; Benson; Bill William's Fork; Bisbee; Bowie; Carr Canyon, Huachuca Mts.; Casa Grande; Chandler; Chandler Heights; Chiricahua Mts.; Cochise; Cochise Co.; Congress; Congress Junction; Continental; Coolidge (17 miles N.); Cortaro; Cottonwood; Dos Cabezas (10 miles S. E.); Douglas; Duncan; Florence Juntion; Fort Huachuca; Fort Thomas; Globe; Hassayampa, Mariposa Co.; McNeill; Mule Mts. (near Bisbee); Nicks, Huachuca Mts.; Oak Creek Canyon, near Flagstaff; Olberg; Oracle; Palmerlee; Patagonia; Payson (10 miles S.); Peppersauce Canyon, Santa Catalina Mts.; Phoenix;

Picacho Pass; Pima Co.; Pinal Mts.; Prescott (32 miles S. and 21 miles S. W.); Ramsey Canyon, Huachuca Mts.; Redington; Red Rock; Rio Aravaipa; Roble's Pass, Tucson Mts.; Roosevelt Lake (E. end); Sabino Canyon, Santa Catalina Mts.; Sacaton; Sahuarita;

FIG. 19. Map showing the distribution of *M. (Melissodes) blanda, M. (M.) paroselae* and *M. (M.) tessellata.*

San Carlos; San Carlos Lake; San Simon; Santa Catalina Mts.; Santa Rita Mts.; Sedona; Seligman; Sentinel; Skull Valley, Yavapai Co.; Sonoita; Stone Cabin Canyon, Santa Rita Mts.; St. Xavier Mt., near Tucson; Sunnyside Canyon, Huachuca Mts.; Superior (E. Thompson Arbor); Tempe; Tombstone; Tucson; Walnut; Wickenburg; Wilcox; Williams; Winslow; Yarnell. California: Calexico, Imperial Co. New Mexico: Deming (23 miles E.); Gallinas Canyon; Hatch; Las Cruces; Lordsburg (10 miles N. E.); Mesilla; Mesilla Valley; Rodeo, Hidalgo Co.; Tularosa (25 miles W.); Tyrone; Willow Creek. Texas: Big Bend National Park, Brewster Co.; El Paso; El Paso Co. Utah: Greenriver. Chihuahua: Matachic (2 miles W.). Nayarit: Tepic (32 miles N. W.). Sonora: Álamos; Bacachaka; Guaymas; Minas Nuevas; Naco; Navojoa; Río Mayo; San Bernardo; Tiburón Island, Gulf of California.

Flower records. *M. paroselae* has been collected on the following flowers: *Acacia* sp., *A. greggii, Argemone* sp., *Asclepias subulata, Aster* sp., *A. canescens, Cucurbita* sp., *Cleome* sp., *C. luteum, Dalea albifrons, Dasylirion wheeleri, Eriogonum* sp., *E. trichopes, Franceria eriocentra, Gaillardia* sp., *Gossypium herbaceum, Helianthus* sp., *H. annuus, Heterotheca subaxillaris, Isocoma* sp., *I. heterophylla, Kallstroemia grandiflora, Larrea* sp., *L. divaricata, Leucophyllum frutescens, Lippia* sp., *Lygodesmia juncea, Medicago sativa, Opuntia* sp., *Parosela scoparia, Pectis papposa, Petalostemum* sp., *Prosopis* sp., *P. glandulosa, Psilostrophe cooperi, Pyrrhopappus multicaulis, Rhus* sp., *Salix* sp., *Senecio longilobus, Thurberia* sp., *T. thespesioides, Verbesina* sp., *V. encelioides, V. exauriculata, Wedelia incarnata, Wislizenia palmeri, W. refracta, Zinnia grandiflora.*

Melissodes (Melissodes) tessellata, sp. nov.

Melissodes communis gratior, Cockerell, 1923, Proc. California Acad. Sci., vol. 12, p. 85 (in part) (misidentification).

This species is recognizable in both sexes by the dense, regular tessellation dulling the ground areas of the mesoscutum, scutellum and mesepisterna. Although *tessellata* is not closely related to any other *Melissodes*, its nearest relative is *M. paroselae* Cockerell, which it resembles in the form of the seventh and eighth sterna of the male.

Female. Measurements and ratios: N, 20; length, 10-13 mm.; width, 4-5 mm.; wing length, M = 4.01 ± 0.236 mm.; hooks in hamulus, M = 14.40 ± 0.184; flagellar segment 1/segment 2, M = 1.95 ± 0.035.

Structure and color: Integument black; legs usually rufescent, at least distitarsi rufescent; flagella below dark reddish-brown; apical areas of terga 2-4 usually somewhat translucent, dark reddish-brown, apical area of tergum 1 similar but often colorless at extreme margin; wing membranes clear to milky, veins dark brown to black. Clypeus with coarse punctures separated mostly by less than one puncture width, round, much smaller and more crowded near apical margin, without a well-marked carina or boss, ground areas dulled by fine regular tessellation; supraclypeal area impunctate or with a few large punctures laterally and one or two medially, ground dulled by dense shagreening; eyes in facial view slightly less than three times as long as broad, converging below; maxillary palpal segments in ratio of about 2:2:2:1, fourth segment often minute; galeae shiny, with scattered punctures. Mesoscutum with minute punctures separated by 2 to 4 puncture widths, ground area opaque, dulled by dense, regular tessellation; scutellum similar, but punctures separated by 1 to 2 puncture widths; lateral surfaces of mesepisterna with round punctures distinctly larger than those of mesoscutum, separated by 1 to 2 puncture widths, occasionally less, ground dulled by dense tessellation; metanotum with sculpturing of scutellum; dorsal and lateral faces of propodeum coarsely punctate, declivous face coarsely punctate except large inverted triangular area in upper half or more, ground coarsely and densely tessellate. First metasomal tergum with small round shallow punctures separated by 1 to 3 puncture widths in basal three fifths, apical area impunctate, ground areas opaque, dulled by dense shagreening; tergum 2 with interband zone impunctate or with minute widely spaced punctures, ground dulled by dense shagreening; apical areas of terga 2 and 3 as in tergum 1; basal area of tergum 3 as in interband zone of tergum 2.

Hair: White on head and thorax except vertex with abundant dark brown hairs, mesoscutum with large patch of dark brown hairs extending forward beyond a transverse line at anterior margins of tegulae and laterally separated from tegulae by one or two rows of white hairs, and scutellum with large median patch of dark brown hairs; tegulae with brown hairs medially. Metasomal tergum 1 with white hairs basally, apical area with brown hairs at least laterally; tergum 2 with white hairs basally, distal pale band about half as wide as apical area medially; tergum 3 with broad white pubescent band which thins markedly medially in worn specimens giving the appearance of two thin bands connected laterally and separated by a zone of erect brown bristlelike hairs,

basally with dark brown tomentum; terga 2 and 3 with erect or suberect dark brown simple hairs in apical areas, unless worn; tergum 4 with broad apical band of white pubescence interrupted medially by rectangular or triangular patch of sparse dark brown simple hairs, with dark brown tomentum basally; terga 5 and 6 with dark brown to black appressed hairs and lateral tufts of long white hairs at least on tergum 5; sternal hairs brown to red medially, becoming white at extreme sides and yellow apically on each sternum. Legs with white hairs except as follows: outer surfaces of fore and middle tibiae near apices brown; basitibial plates and apices of hind femora brown; inner surfaces of tarsi and tibiae golden-yellow to rufescent; scopal hairs white.

Male. Measurements and ratios: N, 20; length, 10-13 mm.; width, 3.0-4.5 mm.; wing length, M = 3.74 ± 0.236 mm.; hooks in hamulus, M = 12.60 ± 0.169; flagellar segment 2/segment 1, M = 10.05 ± 0.204.

Structure and color: Color as in female with the following differences: clypeus and mandibular bases yellow; labrum white; lower surface of flagellum, except first segment, yellow to red. eyes in facial view little more than twice as long as broad, strongly converging below; minimum length of first flagellar segment equals less than one tenth of maximum length of second segment, no longer than pedicle; maxillary palpi and galeae as in female; sculpturing as in female but clypeus less coarsely punctate.

Genitalia much as in *communis;* gonostyli with long simple hairs on lower halves; spatha not emarginate medially. Sternum 7 with median plates flattened and greatly expanded transversely (not oblique as in *communis*), with two sharp apical processes; apodemes short, thin, widely diverging. Sternum 8 with apical margin pointed medially; ventral longitudinal carina reaches apex or slightly beyond (Figs. 101-103).

Hair: Color and pattern of vestiture as in female with the following differences: vertex with few or no brown hairs; mesoscutal patch of dark hairs usually smaller than in female; tergum 3 with broad pale pubescent band which is usually not divided by wear into two thin bands as in female; tergum 4 similar to tergum 3, but pale band thinner; tergum 5 with apical pale band; sternal hairs white to red; legs with white hairs except golden-yellow to rufescent on inner surfaces of tarsi and tibiae.

Type material. Holotype and two male paratypes collected by Jean Russell at Idyllwild, California, August 3, 1935; allotype fe-

male and one female paratype from the San Jacinto Mountains, California, August 5, 1935, E. I. Beamer. One hundred and sixteen male and fifty-six female paratypes from southern California are as follows: Altadena: 1 female, C. D. Michener, June 26, 1935. Banning: 1 male, July 22, 1930, T. F. Winburn and R. H. Painter. Beaumont: 1 female on *Helianthus annuus,* October 8, 1933, P. H. Timberlake. Cajon Pass, San Bernardino Co.: 1 female on *Helianthus* sp., March 19, 1936, G. E. Bohart. Campo: 1 female, Jean Russell, 2 males, E. I. Beamer, 1 male, R. H. Beamer, August 10, 1935. Chula Vista: 1 male, September 4, 1935, F. T. Thorne. Claremont: 1 female and 1 male, July, the O. S. Estcott collection. Corona: 1 female, July, 1910. Devore: 1 female on *Hugelia virgata,* June 23, 1935, P. H. Timberlake. Dos Carin, San Diego Co.: 1 male on *Gutierrezia californica,* August 16. Dulzura: 1 male, August 9, 1935, E. I. Beamer. Encinitas: 1 female, August 1, 1917. Garvalia: 2 females on *Lotus scoparius,* June 21, 1938, P. H. Timberlake. Hemet, Riverside Co.: 1 female, July 21, 1928, P. H. Timberlake; 1 female, July 17, 1945; 1 male on *Medicago sativa,* July 22, 1946, 3 males, August 14, 1946, 3 males on *M. sativa,* August 17, 1946, 1 male, August 24, 1946, 1 female on *Helianthus* sp., August 24, 1946, J. W. MacSwain. Idyllwild: 1 male, July 1936, E. S. Ross. Jacumba: 1 male, August 12, 1917, W. M. Wheeler; 1 male, August 12, 1935, Jean Russell; 4 males and 1 female, August 12, 1935, E. I. Beamer; 1 male, July 17, 1940, R. H. Beamer; 1 male on *Cucurbita factidissima,* August 5, 1947, R. C. Dickson. Los Angeles: 2 males, Coquillett. Mill Creek, San Bernardino Co.: 2 males, August 31, 1930, C. D. Michener. Mountain Springs, Imperial Co.: 3 males, July 25, 1933, L. W. Hepner; 1 female, April 21, 1950, J. W. MacSwain. Pinon Flat, San Jacinto Mts.: 1 female, June 18, 1941, E. C. Van Dyke. Poway, San Diego Co.: 1 female, July 31, 1935, 2 females, May 30, 1935, F. E. Blaisdale. Ribbonwood, San Jacinto Mts.: 1 female on *Malvastrum fasciculatum,* July 2, 1936, P. H. Timberlake. Riverside: 2 males, July 7, 1935, C. M. Dammer; 1 male, July 21, 1935, A. E. Pritchard. The following were collected at Riverside, California, by P. H. Timberlake: 1 female on *Brassica juncea,* June 14, 1926: 2 males on *Trichostema lanceolata,* September 15, September 22, 1926; 1 female on *Encelia farinosa,* May 12, 1927; 1 female on *Lotus scoparius,* June 14, 1927; 1 female on *Helianthus annuus,* June 28, 1927; 1 male on *Marrubium vulgare,* July 6, 1927; 2 females on *Gutierrezia sarothrae,* July 8, 1927; 1 male on *Senecio douglasii,* July 25, 1927; 1 male on *Croton cali-*

fornica August 3, 1927; 2 males on *L. scoparius,* August 4, 1927; 2 males on *G. sarothrae,* August 8, 1927; 1 male on *S. douglasii,* 1 male on *C. californica,* 1 male on *Eriogonum fasciculatum,* 1 male on *G. sarothrae,* August 30, 1927; 1 male on *Stephanomeria* sp., September 7, 1927; 1 male on *T. lanceolata,* September 9, 1927; 2 males on *Isocoma vernonioides,* September 18, 1927; 1 male on *Stephanomeria virgata,* September 26, 1927; 1 female, 1 male on *G. sarothrae,* November 3, 1927; 1 male on *G. sarothrae,* November 15, 1927; 1 female on *G. sarothrae,* November 18, 1927; 1 male on *Chrysanthemum segetum,* July 2, 1928; 1 female on *G. sarothrae,* July 10, 1928; 1 male on *C. segetum,* July 9, 1928; 1 male on *L. scoparius,* 1 female on *G. sarothrae,* July 5, 1928; 1 male on *Centaurea* sp., July 6, 1928; 1 male on *G. sarothrae,* July 26, 1928; 2 males on *G. sarothrae,* September 3 and 4, 1929; 1 female on *Medicago sativa,* July 21, 1930; 1 male on *Hemizonia paniculata,* July 23, 1930; 2 males on *M. sativa,* August 6, 1930; 1 male on *T. lanceolata,* 1 male on *E. fasciculatum,* August 8, 1930; 2 males on *G. sarothrae,* 1 male *S. douglasii,* August 11, 1930; 1 male on *G. californica,* 1 male on *Corethrogyne* sp., August 12, 1930; 3 females on *Opuntia parcyi,* May 16, 18 and 26, 1932; 1 female on *L. scoparius,* May 31, 1932; 1 female on *Godetia amoena,* June 13, 1932; 3 females on *Clarkia elegans,* June 16, 1932; 1 female on *G. sarothrae,* July 17, 1932; 1 male on *Corethrogyne filaginifolia,* August 16, 1932; 1 male on *H. paniculata,* August 26, 1932; 1 male on *T. lanceolata,* September 15, 1932; 1 female on *G. sarothrae,* October 28, 1932; 1 male on *G. californica,* August 18, 1933; 1 male on *G. sarothrae,* August 31, 1933; 1 male on *H. annuus,* September 9, 1933; 1 female on *Corethrogyne* sp., 1 female on *G. sarothrae,* September 14 and 15, 1933; 2 females on *Pluchea camphorata,* May 15, 1935; 1 female, July 2, 1935; 1 male, August 2, 1935; 2 males, August 6, 1935; 2 males on *G. californica,* August 29, 1935; 2 females, 3 males, on *P. camphorata,* September 1, 1935; 1 male on *G. californica,* September 3, 1935; 2 females, 2 males on *P. camphorata,* and 1 male on *Polygonum lapathifolium,* September 8, 1935; 1 male on *Lippia filiformis,* September 5, 1935; 6 males on *T. lanceolata,* September 20, 1935; 2 males, July 28, 1936; 2 males on *Baccharis glutinosa,* July 29, 1936; 2 males on *Corethrogyne* sp., August 12, 1936; 1 male on *G. californica,* September 12, 1936; 3 males, July 29, August 4 and 5, 1938. San Diego: 1 female, August 7, 1935, Jean Russell. San Felipe Valley, San Diego Co.: 1 female on *Asclepias* sp., July 7, 1940, C. D. Michener; 1 male, September 11, 1938; 2 males, July 6, 1935; F. W. Thorne. San Jacinto Mts.: 2 females, August 7, 1935, E. I. Beamer.

Valley of the Falls, Riverside Co.: 1 male on *Monardella villosa,* September 7, 1935, P. H. Timberlake. Westwood Hills, Los Angeles Co.: 1 female on *Helianthus* sp., March 19, 1936, G. E. Bohart. Whitewater, Riverside Co.: 1 female, July 9, 1950, E. G. Linsley; 1 male on *Gebbia juncea,* September 11, 1935, P. H. Timberlake. Yorba Linda, Orange Co.: 1 male on Anise, August 5, 1920, P. H. Timberlake. The holotype and allotype are in the Snow Entomological Museum at the University of Kansas. Paratypes are in the collections of the Snow Entomological Museum, the American Museum of Natural History, the U. S. National Museum, the California Academy of Science, the Academy of Natural Sciences of Philadelphia, the Museum of Comparative Zoology, Harvard University, the Citrus Experiment Station, Riverside, California, the University of Minnesota and in the author's collection.

Distribution. Southern California as far north as Santa Clara County, Baja California and western Mexico as far south as Cocula, Jalisco (Fig. 19). In addition to the type material listed above, 16 females and 17 males were examined from the localities listed below.

CALIFORNIA: Santa Clara Co.; "southern California." BAJA CALIFORNIA: Ángel de la Guardia Island (Pond Island Bay and Puerto Refugio); Catavinia (10 miles S.); Ensenada (12 miles N.); La Paz; San Marcus Island, Gulf of California; San Francisquito; Todos Santos. JALISCO: Cocula.

Remarks. The specimens from Ángel de la Guardia Island (7 males) and San Marcus Island (1 male) are part of the cotype series of *M. communis gratior* Cockerell.

Flower records. This species visits a large number of species of plants for pollen and nectar. These plants are listed above with the other data for the type specimens. Females have been collected more often on composites than on plants of other families. Whether this indicates some degree of oligolecty cannot be decided on the basis of the number of records available.

Subgenus ECPLECTICA Holmberg.

Ecplectica Holmberg, 1884, Actas Acad. Nac. Cienc. Córdoba, vol. 5, p. 123.
Melissodes Brèthes, 1909, Anal. Mus. Nac. Buenos Aires, vol. 19 (ser. 3, vol. 12), p. 220.

Type Species. Ecplectica tintinnans Holmberg, 1884 (monobasic).

Female. With structural and color characters of the subgenus

Melissodes with the following differences: clypeus always relatively flat; metasomal *terga always black, never broadly hyaline apically, almost always with slight, but distinct, violaceous reflections,* usually with apical areas relatively coarsely punctate and shiny or moderately so.

Characters of vestiture as in the subgenus *Melissodes* with the following differences: usually somewhat melanistic with abundant black or dark brown hairs on head and thorax; *mesoscutum with large posteromedian patch of dark hairs which usually extends forward to or beyond a transverse line at anterior margins of tegulae and often with anterolateral extensions in front of tegulae and fusing with dark hair patches of posterior pronotal lobes; tergum* 2 with basal pubescent band never consisting of spatuloplumose hairs, *with distal pubescent band absent or reduced to thin, short, lateral* faciae; tergum 3 usually with short simple golden-yellow hairs fringing apical margin at least laterally.

Male. With characters of color, sculpture and vestiture of the subgenus *Melissodes* with the following differences: labrum always entirely pale in color; *metasomal terga black, never hyaline apically, usually exhibiting metallic, violaceous reflections;* hairs often melanistic with thoracic and tergal characters of female, but mesoscutum often somewhat paler; *minimum length of first flagellar segment equals about one tenth of maximum length of second segment or less* (occasionally slightly more, but never as much as one ninth of second segment in the species involved in this revision), antennae very long, reaching beyond second metasomal tergum in repose.

Gonocoxite with dorsal carina not developed into a blunt, mesally directed process; *gonostylus very short, usually no longer than one third of length of gonocoxite, twice as broad basally as near apex, narrowing rather abruptly near middle, never capitate, with only short hairs on outer surfaces and near base. Sternum 7 with median plate enlarged, flattened, transparent, not curled or folded ventrally, with several short hairs ventrally, but never highly pilose; lateral plate narrow, long, testaceous, without a distinct, laterally directed, apical process, but with apex abutting dorsal surface of median plate;* apodemes simple, acuminate, not capitate, broad basally. Sternum 8 much as in the subgenus *Melissodes,* but median longitudinal ventral carina short, relatively low and broad.

Remarks. In a personal communication dated October 7, 1954, Padre J. S. Moure informs me that *E. tintinnans* Holmberg is a synonym of *Melissodes nigroaenea* Smith (1854). A series of

specimens of *M. nigroaenea* from Perú deposited in the U. S. National Museum were identified by Miss Grace A. Sandhouse as *Melissodes nigroaenea* subspecies *tintinnans* Holmberg, and it is evident from this that Sandhouse considered *tintinnans* as no more than a subspecies of *nigroaenea.* From the foregoing information the type species of *Ecplectica* most likely is *M. nigroaenea* Smith; however, since the author has not had the opportunity to study critically the South American species, the formal synonymy of these forms will not be presented in this work.

Cockerell stated in a paper published posthumously (Cockerell, 1949, p. 467) that the species described in that paper (*Melissodes atripicta*), ". . . may eventually be taken as the type of a new genus or subgenus."

Melissodes (Ecplectica) trifasciata Cresson.

Melissodes trifasciata Cresson, 1878, Proc. Acad. Nat. Sci. Philadelphia, vol. 30, p. 208; Cockerell, 1906, Trans. Amer. Ent. Soc., vol. 32, p. 87; Cresson, 1916, Mem. Amer. Ent. Soc., vol. 1, p. 133.
Melissodes insularis Crawford, 1914, Proc. U. S. Nat. Museum, vol. 47, p. 132 (new synonymy).

This is a distinct West Indian species which can be readily separated from *M. raphaelis* in both sexes by the complete or almost complete lack of the distal pale band of tergum 2 and by the less punctate basal area of tergum 1. In addition, both sexes are paler in habitus, have red or orange legs and have generally finer punctation, although still dense, on the apical areas of terga 2 and 3.

Female. Measurements and ratios: N, 20; length, 8.5-11.0 mm.; width, 3.5-4.5 mm.; wing length, $M = 3.42 \pm 0.216$ mm.; hooks in hamulus, $M = 11.65 \pm 0.167$; flagellar segment 1/segment 2, $M = 1.87 \pm 0.024$.

Structure and color: Integument black; legs dark red; hind basitarsi basally, hind tibiae distally and hind femora below often orange; sterna dark reddish-brown; tegulae testaceous to piceous; mandibles red medially; flagella red below, except first two segments and black above; eyes greenish-gray; wing membranes clear, veins black. Sculpturing of head and thorax as in *raphaelis* with the following differences: lateral flattened areas of vertex with small round deep punctures separated by one puncture width or less, ground spaces shiny, usually without shagreening, occasionally delicately so; propodeum with punctures of dorsal face larger, three times as wide as punctures of metanotum or more, medially impunctate and irregularly tessellate; maxillary palpal segments in

ratio of about 2.5:2:1.5:1.5, fourth segment occasionally shorter. With sculptural characters of metasoma as in *raphaelis* with the following differences: tergum 1 with basal three fourths coarsely punctate, punctures small, medially separated by one to two puncture widths; tergum 2 with punctures of interband zone small, separated by 2 puncture widths or more medially and by 1 or 2 puncture widths laterally; apical areas of terga 2 and 3 with minute punctures, but about as wide as three times basal width of the extremely fragile appressed hairs arising from them, separated by 1 to 3 puncture widths or more.

Hair: Vestiture as in *raphaelis* with the following differences: on head mostly white except abundant black hairs on vertex and often a few interspersed with the pale on face as far down as clypeus; mesoscutum often with grayish-white hairs posteromedially in middle of patch of black hairs, occasionally anterolateral arms of black patch obsolete; on mesepisterna white, except black hairs on ventral surfaces, a few to many on anterior surfaces and a few to several in upper anterior angles; propodeal and metepisternal hairs white; tergum 2 with pale distal band completely absent or represented by two or three minute silvery-white appressed hairs laterally; tergum 3 without golden-yellow hairs fringing apical margin; tergum 4 with median patch of suberect black hairs broadly triangular in outline with the base of triangle on apical margin; tergum 5 without pale hairs laterally; legs often with white hairs on femora and at least anterior surfaces of tibiae, with red to yellow on inner surfaces of tibiae and basitarsi; scopal hairs ochraceous to orange.

Male. Measurements and ratios: N, 20; length, 7.5-10.0 mm.; width, 2.5-3.5 mm.; wing length, $M = 3.38 \pm 0.260$ mm.; hooks in hamulus, $M = 11.20 \pm 0.186$; flagellar segment 2/segment 1, $M = 10.44 \pm 0.142$.

Structure and color: Integument black; clypeus yellow; labrum cream-colored to white; bases of mandibles often without yellow spots, often translucent orange basally; legs red, at least tibiae and tarsi usually orange-red or orange; sterna dark brownish red; terga dark brownish-red to black apically, flagella, except first segment, yellow to red below, reddish-brown to black above. Sculpturing as in female with the following differences: clypeal punctation obscure; mesoscutum more often impunctate posteromedially; mesepisterna often with ground areas more densely shagreened; tergum 1 with basal five sixths punctate; terga 2 to 4 with apical

impunctate margins at least as wide as that on tergum 1 and often somewhat wider; maxillary palpi as in female.

Hair: On head ochraceous in palest specimens, vertex usually with abundant dark brown hairs, face often with a few to several dark brown hairs mixed with the pale, especially near and on clypeus and extending from vertex to clypeus just mesad of compound eyes. Mesoscutal hairs ochraceous in palest specimens, usually with a large posteromedian square patch of dark reddish-brown hairs, dark hairs never reaching forward and laterally in front of tegulae; scutellum with abundant dark hairs medially; tegulae often with dark hairs; lateral surfaces of thorax and propodeum with ochraceous hairs. Metasoma with vestiture as in female with the following differences: tergum 2 rarely with short, extremely thin, lateral fasciae of pale pubescence medially (present in type of *insularis*); tergum 4 with a pale pubescent band similar to that of tergum 3 but narrower. Legs with ochraceous to orange hairs except as follows: basitibial plates and usually outer surfaces of hind tibiae dark brown; occasionally outer surfaces of middle tibiae brown; inner surfaces of tarsi yellow to orange.

Gonostylus with basal half or somewhat less broad in lateral view. Sternum 7 with apical margin of median plate with a rather sharp median angle and well rounded laterally; membraneous area between median and lateral plates about as long as median plate. Sternum 8 with apical margin emarginate; lateral apodemes truncate, with anterior margin concave or sinuate (Figs. 104-106).

Type material. Holotype female of *trifasciata* from Porto Rico in the Academy of Natural Sciences of Philadelphia. Holotype male of *insularis* from Dominica, June-July, 1913, H. V. Foote, in the U. S. National Museum (U. S. N. M. Type No. 16732).

Distribution. The Lesser Antilles from Dominica in the south, north and west to Mona Island in the Greater Antilles. This species has been collected in all months of the year except September and November. In addition to the type material, 30 females and 172 males have been examined from the localities listed below (including localities reported in the literature).

DOMINICA: "Dominica." MONA ISLAND: "Mona Is." PUERTO RICO: Adjuntas; Aguirre; Aibonito; Añasco; Arecibo; Barceloneta; Barros; Bayamón; Caguas; Coamo Springs; Corozal; Crocouis; Fajardo; Isabela; Manatí; Naguabo; Parquera; Río Piedras; Utuado. VIRGIN ISLANDS: St. Croix; St. Thomas; "Virgin Is."

Flower records. M. trifasciata has been collected on flowers of the following plants: *Crotolaria* sp., Roble, Sweet Potato.

Melissodes (Ecplectica) raphaelis Cockerell

Melissodes raphaelis Cockerell, 1898, Ann. Mag. Nat. Hist., ser. 6, vol. 18, p. 292; 1899, Catálogo de las Abejas de Mexico, p. 13; 1912, Ann. Mag. Nat. Hist., ser. 8, vol. 10, p. 28.
Melissodes atripicta Cockerell, 1949, Proc. U. S. Nat. Museum, vol. 98, p. 467 (new synonymy).

This species can be distinguished from *M. trifasciata* by having the distal pale band of tergum 2 present, although reduced to short, thin, lateral fasciae in both sexes. The males have the median plates of sternum 7 larger than in *trifasciata.* Both sexes have the apical areas of the terga more coarsely punctate than in *trifasciata* and the females of *raphaelis* have a diamond-shaped median patch of black hairs on tergum 4, and usually has tergum 3 fringed with golden-yellow hairs apically at least laterally.

Female. Measurements and ratios: N, 3; length, 11 mm.; width, 4.5 mm.; wing length, M = 3.67 ± 0.038 mm.; hooks in hamulus, M = 11.67 ± 0.333; flagellar segment 1/segment 2, M = 1.81 ± 0.467.

Structure and color: Black, distitarsi dark reddish-brown; mandibles rufescent apically; flagella usually slightly paler below; tegulae dark brown to black; wing membranes somewhat infumate, brownish, veins dark brown to black; eyes dark greenish-brown to black. Clypeus with abundant, shallow punctures separated mostly by half of one puncture width, ground dulled by dense, fine tessellation; supraclypeal area with scattered round punctures, ground dulled by coarse tessellation; lateral flattened areas of vertex with abundant small round punctures separated by one puncture width or less, ground dulled by dense, irregular shagreening or tessellation; elsewhere face coarsely punctate and moderately shiny; maxillary palpal segments in ratio of about 2.5:2:1.5:1. Mesoscutum with abundant round punctures separated by half of one puncture width or less anteriorly and laterally, and by 1 to 3 puncture widths posteromedially, ground smooth and shiny; scutellar sculpturing similar to that of anterior part of mesoscutum, but punctures sparser medially and irregular in size; mesepisternal punctures about same size as those of mesoscutum, crowded, separated mostly by half of one puncture width or less, ground somewhat dulled by delicate, irregular shagreening; metanotum with punctures of same diameter as those of mesoscutum, separated mostly by half of one puncture width, ground dulled by coarse shagreening, except medially on dorsal surface; propodeum with dorsal face coarsely punctate, punctures twice as wide as those of metanotum, ground

often dulled by fine tessellation, except medially; declivous face coarsely punctate and tessellate except impunctate, shiny, inverted triangle, lateral faces coarsely punctate and tessellate. Metasomal tergum 1 with coarse punctures separated mostly by less than one puncture width in basal half, ground areas and surface of apical area dulled by extremely fine, transverse shagreening, shiny to moderately so; tergum 2 with interband zone (or raised lateral areas if distal pubescent band is absent) with coarse punctures separated by 2 or more puncture widths medially and mostly by 1 puncture width or less laterally, apical area with coarse punctures separated by less than one to three puncture widths, about as wide as three times width of appressed dark brown hairs arising from them, ground area shiny or moderately so, with fine transverse shagreening; tergum 3 similar to tergum 2 but basal area somewhat more punctate; tergum 4 similar but surface beneath apical pubescent band more densely punctate than apical areas of terga 2 and 3; sterna coarsely punctate except narrow impunctate apical margins, ground dulled by fine tessellation.

Hair: On head white with abundant black hairs on vertex and extending somewhat onto face medially and laterally as far as the clypeus, mixed black and white on clypeus in ratio of about 1:8 and labrum with all black hairs. Mesoscutum with black posteromedian hair patch extending forward beyond a transverse line at anterior margins of tegulae and extending laterally near anterior end in front of tegulae to fuse with posterior pronotal patch of black hairs, this leaves a narrow semicircular strip of white hairs along anterior margins of and a narrow strip of white hairs mesad to tegulae and along mesoscuto-scutellar suture; scutellum with hairs mostly black, a few white hairs at extreme posterior margin; propodeum with white hairs dorsally and posteriorly, with black hairs laterally except a small tuft of white hairs anterior to propodeal spiracles; mesepisternal hairs black ventrally, anteriorly, on lateral surfaces above and below and mixed black and white or all white medially on lateral surfaces; metepisternal hairs white or white and black mixed. Metasomal tergum 1 with long white hairs in basal half or less, with short appressed black hairs apically; tergum 2 with complete basal band of grayish-white pubescence, with thin, short, lateral fasciae of white pubescence medially, lateral fasciae not fused with basal pale band laterally and in length each equals less than one third of width of tergum, interband zone and apical area with appressed or subappressed,

simple, black hairs; tergum 3 with median band of grayish-white or yellowish-white pubescence which is about as broad as apical area medially, but sparse and diffuse anteriorly so that the narrow, distal, dense portion appears almost as a distinct band, apical margin fringed with at least several simple golden-yellow hairs laterally and these may extend almost across tergum, elsewhere as in tergum 2; tergum 4 with broad apical band of yellowish-white hairs interrupted medially by a broadly diamond-shaped patch of simple suberect black hairs; terga 5 and 6 with long black appressed hairs and a few ochraceous pale hairs laterally; sternal hairs dark brown, pale laterally near apex of each sternum. Legs with dark brown to black hairs except as follows: inner surfaces of tarsi dark red to reddish-brown, scopal hairs, except those immediately below basitibial plates, and hairs of upper surfaces of femora ochraceous.

Male. Measurements and ratios: N, 6; length, 8.5-10.0 mm.; width, 2.5-3.5 mm.; wing length, $M = 3.19 \pm 0.566$ mm.; hooks in hamulus, $M = 11.00 \pm 0.365$; flagellar segment 2/segment 1, $M = 11.44 \pm 0.465$.

Structure and color: Integument black; distitarsi and sterna often dark red; clypeus and triangular spots at bases of mandibles yellow; labrum white; flagella red below, dark reddish-brown above; wing membranes clear, veins dark brown to black; eyes grayish-green to dark gray. Sculpturing as in female with the following differences: clypeal punctation obscure; mesoscutum often with small posteromedian impunctate area, ground spaces shiny, but often with delicate, sparse shagreening; mesepisterna usually duller, ground spaces more distinctly shagreened and punctures slightly more widely spaced; tergum 1 coarsely punctate except apical fifth or less; terga 2-4 with narrow apical impunctate zones equal to that on tergum 1 or somewhat broader; maxillary palpi as in female. Minimum length of first flagellar segment equals less than one tenth of maximum length of second segment.

Gonostylus with basal three fifths broad in lateral view. Sternum 7 with apical margin of median plate with three blunt angles; membraneous area between median and lateral plates short, equal to less than length of median plate. Sternum 8 with apical margin sharply truncate, straight or evenly and gently concave, with long plumose hairs apically; lateral apodemes with anterior margins evenly rounded and each with a short posterior, pointed process (Figs. 108-110).

Hair: On head usually yellowish to grayish-white, often with

abundant black hairs on vertex, face and clypeus. Mesoscutum with whitish hairs and a posteromedian patch of black hairs; scutellar hairs black except posterior fringe of white hairs; lateral surfaces of thorax and propodeum with grayish-white hairs, often with black hairs on upper part of mesepisternum; occasionally with thoracic hairs essentially as dark as in female and with the same pattern. Metasomal vestiture as in female with the following differences: tergum 5 with a complete apical pale pubescent band; tergum 4 with a pale band similar to that of tergum 3; terga 3 and 4 without golden-yellow hairs fringing apical margins; terga 6 and 7 with black hairs; sternal hairs mostly dark brown, whitish laterally. Legs with grayish-white hairs except as follows: inner surfaces of tarsi red, outer surfaces of hind tibiae at least posteriorly and usually outer surfaces of fore and middle tibiae dark brown.

Type material. Holotype male of *raphaelis* from San Raphael, Veracruz, Mexico, on *Ipomoea* sp., C. H. T. Townsend (U. S. N. M. Type No. 3355), and the holotype female of *atripicta* from Zamorano, Honduras, A. Pelén (U. S. N. M. Type No. 58553) are in the U. S. National Museum.

Distribution. Southeastern Mexico, Guatemala and Honduras. This species is known from so few examples that it seems more useful to indicate the full collecting data here. The data for the type material are not repeated, but information from the literature is included.

MEXICO: San Raphael, Veracruz, 2 females, March 22 and 23, 1 male, March 8, C. H. T. Townsend; Motzorongo, Veracruz, 1 male, February 11, 1892, H. Osborn; Lower part of the Río Nautla, Veracruz (Cockerell, 1899). GUATEMALA: Quirigua, 4 males, on *Ipomoea sidaefolia*, W. P. Cockerell.

Tachymelissodes, subgenus nov.

Type species. Melissodes dagosa Cockerell, 1909.

This subgenus consists of three species from southwestern United States and northern Mexico. The species are all small and are distinctive because of the apical pubescent bands of the terga and the short male antennae.

Female. Small to medium-sized bees; integument generally black, terga often transparent or translucent beneath apical pubescent bands, without violaceous reflections; wings clear, hyaline or milky, veins dark brown to black. Clypeus flat, not strongly

protruding from face, not forming an abrupt step from supraclypeal plane to a flat clypeal plane, half as long as wide or slightly less; *eyes* less than half as wide as long and more than one third as wide as long in facial view, strongly converging towards mandibles, *as wide as genal areas in profile or slightly narrower;* minimum length of second flagellar segment distinctly shorter than width near apex and less than third segment; *galeae sparsely punctate above, without shagreening except at tips*; maxillary palpi 4-segmented, fourth segment always minute. Integument of head, thorax and metasomal terga generally punctate, ground areas smooth and shiny or moderately so, shagreening sparse and fine, except occasionally on terga; *terga not conspicuously punctate beneath apical pubescent bands; tegulae evenly rounded laterally in posterior two thirds, with lateral margin concave or straight in anterior third or slightly more* (Figs. 36, 37) *narrowed anteriorly;* metanotum about equal to dorsal face of propodeum in length medially; propodeum with dorsal face irregularly rugose and tessellate, not distinctly punctate apically.

Hairs generally silvery-white, often with brown to black hairs on mesoscutum, scutellum, mesepisterna and legs. Metasomal tergum 1 with long plumose hairs in basal half, with minute, scattered, brown hairs in basal half of apical area, apical fourth bare; *terga 2, 3 and 4 with apical bands of long silvery-white pubescence approximately equal in width to each other and of about equal width across each tergum, although often narrowed medially on tergum 2; tergum 2 with a short, indistinct, basal band of sparse, weakly plumose pubescence which is separated from apical pale band by at least the width of the latter*; terga 5 and 6 with long black appressed hairs, often with lateral tufts of white hairs on tergum 5. Scopal hairs white, weakly plumose, scarcely hiding outer surfaces of basitarsi and tibiae; inner surfaces of hind basitarsi with red to black hairs.

Male. Clypeus yellow; *labrum at least with apical margin dark brown to black, often entirely dark*; bases of mandibles with or without yellow spots; *metasomal terga with apical margins translucent yellow to transparent and colorless,* never piceous. Structural characters as in female with the following differences and additions: *minimum length of first flagellar segment equals at least half of maximum length of second segment and usually more; antennae extremely short, scarcely, if at all, reaching base of first metasomal tergum in repose; seventh tergum, as well as sixth, with lateral, apical spines*; pygidial plate notched on each side near apex.

Gonostylus simple, turned inwards near apex, with few short hairs on outer surface near base; penis valve short, lateral process short; *dorsal carina of gonocoxite not produced into a blunt process. Sternum 7 with median plate flat, expanded apically and laterally near apex, apical margin relatively straight, not rounded, somewhat oblique, ventral surface with abundant, extremely short, weak hairs,* apex well separated from apex of lateral plate; with *lateral plate piceous at least apically, with a short apicolateral process. Sternum 8 short, almost as broad as long, truncate, with apical margin simply transverse or with a small acuminate protuberance medially,* evenly rounded or slightly concave apicolaterally, with several weak hairs apically; lateral apodemes large, truncate; ventral longitudinal carina obsolete or weakly developed as a rather sharp, short, median protuberance well separated from apex of sternum (Figs. 118-121).

Vestiture as in female with the following additions: tergum 5 with an apical pubescent band similar to those on terga 2 to 4; terga 6 and 7 with long, appressed, white to golden-yellow hairs, never brown; hairs and pubesence generally golden-yellow rather than white in newly emerged specimens, becoming white with age.

Heliomelissodes, subgenus nov.

Type species. Melissodes desponsa Smith, 1854.

This subgenus consists of two, and possibly three, species, one of which is polytypic. The subgenus is widespread throughout the United States and southern Canada and includes two of the most common North American species of *Melissodes.*

Female. Integument generally black; terga piceous, not translucent or hyaline apically, without violaceous reflections; wing membranes often infumate, veins dark brown to black. *Clypeus in profile protruding beyond face by half of width of eye or more, with crowded, small, irregular punctures; eyes* in facial view almost three times as long as wide, converging slightly towards mandibles, *usually slightly narrower in profile than genal areas; galeae more than twice as long as clypeus, shiny or dulled by dense shagreening at least in apical third;* maxillary palpi 4-segmented, fourth segment minute; minimum length of second flagellar segment as long as width near apex and as long as or longer than third segment. Thorax coarsely punctate, ground areas often densely shagreened; metanotum usually slightly, but distinctly, shorter than dorsal face of propodeum medially; propodeum with dorsal face irregularly

rugose and densely tessellate, not distinctly punctate apically; tegulae with lateral margins concave anteriorly (Fig. 33).

Vestiture various but thorax and tergum 2 never with spatuloplumose hairs; terga never with apical pubescent bands (except tergum 4); scopal hairs with few branches and a strongly developed rachis, ochraceous to yellow; inner surfaces of hind basitarsi with dark reddish-brown to black hairs.

Male. Labrum black; mandibles without basal yellow spots; clypeus often partially black posteriorly; terga without violaceous reflections, never translucent or transparent apically; wing membranes often infumate, veins dark brown to black. With structural characters of female with the following additions: *minimum length of first flagellar segment equal to one third of maximum length of second segment or slightly more; antennae moderately long, reaching first metasomal tergum in repose but not to apical margin;* tergum 7, as well as 6, with lateral spines near apex.

Gonostylus simple, not turned in near apex, not capitate, not conspicuously broader near base than near middle, basal half to two thirds broader than distal portion, with abundant short hairs on outer and ventral surfaces; penis valve rather long and thin; dorsal carina of gonocoxite not produced into a blunt process. *Sternum 7 with lateral plate piceous, with a distinct, pointed, apical process directed somewhat laterally, long and narrow, twice as long as wide or longer; median plate large, three times area of lateral plate or more, with abundant short hairs covering ventral surface.* Sternum 8 much longer than wide, irregularly acuminate in apical fourth or third, emarginate apically, with abundant simple hairs apically; ventral carina short, near apex bidentate or bilobed and transverse; lateral apodemes short, bidentate apically (Figs. 114-117).

Vestiture as in female with the following addition: terga 6 and 7 often with black or dark brown hairs.

Psilomelissodes, subgenus nov.

Type species. Melissodes intorta Cresson, 1872.

This subgenus includes only one relatively rare species from the southern part of the Great Plains of the United States. Its distinctive features were recognized by C. D. Michener who drew up a brief manuscript description placing *M. intorta* in a new genus, but did not publish it because the female was then unknown to him.

Female. Integument black; terga with apical areas usually trans-

lucent or transparent; eyes grayish-blue to black; wing membranes not infumate, clear, yellowish, veins dark brown to black; tegulae piceous. Clypeus relatively flat, arising gradually from plane of supraclypeal area, slightly less than half as long as wide in facial view; *eyes* more than one third as long and less than one half as wide as long in facial view, strongly converging towards mandibles, *distinctly wider than genal areas in profile;* minimum length of second flagellar segment equal to width or longer, distinctly longer than third segment; galeae sparsely punctate above, smooth and shiny except tips, with short straight hairs; maxillary palpi 4-segmented, segment 4 minute, segment 2 longest. Integument of head and thorax coarsely punctate, shiny or moderately so, ground areas with no or delicate shagreening; *tegulae with lateral margins straight or concave in anterior half or third,* not evenly convex laterally but narrowing anteriorly. Metasomal terga extremely weakly and sparsely punctate, ground areas completely dulled by fine, dense, regular, transverse shagreening; metanotum slightly longer than dorsal face of propodeum medially; propodeum with dorsal face irregularly rugose, becoming densely tessellate apically.

Vestiture weak and sparse; pale hairs and pubescence white; thorax without spatuloplumose hairs; metasomal tergum 1 with moderately long hairs in basal third or more and along extreme sides of dorsal surface; *tergum 2 with basal pale band of plumose pubescence, with extremely narrow lateral fasciae of short white pubescence medially which almost, but not quite, meet medially, apical area bare or with extremely sparse, plumose, minute hairs laterally; tergum 3 similar to tergum 2,* but with more abundant hairs basally and with brown tomentum at extreme base; *tergum 4 with apical band of short, relatively sparse, white pubescence,* basally with more sparse white pubescence similar to that of apical band, with brown tomentum at extreme base and with erect brown bristlelike hairs in basal area; *terga 5 and 6 with dark brown hairs; scopal hairs weak, not at all hiding surfaces of basitarsi and tibiae, usually with two, occasionally three and often only one, long, weak branch on each side of the long weak rachis.*

Male. With characters of color and structure as in female with the following additions: *Clypeus, labrum and bases of mandibles black; antennae short, femalelike, not reaching beyond propodeum in repose; minimum length of first flagellar segment equals maximum length of second segment or slightly more;* seventh tergum

with lateral spines similar to those of fifth and sixth sterna; pygidial plate with notches laterally near apex; sternum 6 deeply grooved medially, shiny.

Gonocoxite with dorsal carina not produced into a blunt process; *gonostylus large, thick, less than three times as long as greatest width in dorsal view*, narrowest near middle, with several minute hairs basally on ventral surface, and with several minute hairs along midline in basal half or two thirds of dorsal surface; penis valve large, lateral process long and hooked. *Sternum 7 with median plate flat, transparent, transversely oval in outline, with minute hairs ventrally, with broad, long neck about as large as the plate itself; lateral plate about as large as median plate, piceous apically, with minute hooked process at apex near median plate;* lateral apodemes broad, truncate. *Sternum 8 not emarginate apically, apex with short weak hairs;* lateral apodemes truncate or obscurely bidentate, curved anteriorly (Figs. 122-125).

Vestiture as in female with the following additions: terga 4 and 5 with pubescence as in tergum 3 of female; terga 6 and 7 with brown hairs.

Apomelissodes, subgenus nov.

Type species. Melissodes fimbriata Cresson, 1878.

This subgenus includes two species. The subgenus extends over the southeastern United States as far west as Texas and as far north as Kansas and Virginia.

Female. Integument black; terga piceous, not translucent or transparent apically; without violaceous reflections; wing membranes clear, yellowish, veins dark brown to black; eyes yellowish-gray to grayish-green; tegulae piceous. *Clypeus protuberant, extending beyond face by much more than half of width of eye in profile and often by as much as width of eye*, arising gradaully from plane of supraclypeal area, about half as long as wide; *eyes narrow*, about three times as long as wide in facial view, *distinctly wider than genal area in profile;* second flagellar segment usually shorter than or about as long as wide, occasionally longer; *galeae smooth and shiny or very weakly shagreened, with sparse punctures bearing weak straight hairs, or with more abundant punctures bearing hooked hairs at least laterally, more than twice and often almost three times as long as median length of clypeus; maxillary palpi 3-segmented with the third segment minute, or 4-segmented with fourth segment minute and second and third segments long. Head and thorax* coarsely punctate, ground areas generally smooth

and shiny; *tegulae with lateral margins concave anteriorly;* metanotum as long as dorsal face of propodeum medially or longer; propodeum with dorsal face coarsely and irregularly rugose basally, often punctate apically but punctures obscured by coarse, irregular tessellation. Metasomal terga weakly punctate, ground areas dulled by dense, fine, regular, transverse shagreening.

Thorax and metasomal tergum 2 without spatuloplumose hairs; tergum 1 with long weak hairs in basal half or slightly more; *tergum 2 with narrow white basal pubescent band* which is often hidden completely beneath apical margin of tergum 1, *with narrow apical band of about same width across tergum or somewhat narrower medially; terga 3 and 4 with apical bands similar to that of tergum 2,* with dark brown tomentum at extreme bases; *scopal hairs simple, without branches, or weakly plumose, with only 2 to 4 weak branches on either side of a strong rachis, white to yellow.*

Male. With characters of color and structure of female with the following additions: *clypeus wholly yellow to wholly black; labrum and bases of mandibles black; antennae long, reaching apex of first metasomal tergum or beyond in repose; minimum length of first flagellar segment equals one fifth or less of maximum length of second segment;* terga 6 and 7 with lateral spines, but these weakly developed on tergum 5; pygidial plate with distinct lateral notches near apex, narrowing basally, longer than greatest width, often lateral notches extremely deep and pygidial plate thus divided into two portions which are on different levels, the longer basal portion being on a level above the short apical portion.

Gonocoxite with dorsal carina simple, not produced into a blunt process; *gonostylus long, half as long as gonocoxite or longer in dorsal view, thick, not capitate, narrowing slightly in apical third, with sparse, minute, weak hairs near base and on outer surface; penis valve notably narrow, ratio of greatest width of valve to greatest width of gonostylus about 4:3 or 5:4 never twice as wide as gonostylus, lateral process extremely short, blunt or obsolete. Sternum 7 with median plate greatly expanded, with or without a distinct neck region, with abundant weak hairs ventrally, median emargination of sternum usually reduced, lateral flange which joins median plate to the dorsum of lateral plate large, becoming practically dorsal in position due to the reduction of the lateral plate; lateral plate small, with a scarcely recognizable blunt apicolateral process or none, round to oval in outline, testaceous to piceous, equal to less than half of median plate in area; median membranous*

area between median and lateral plates extremely large, triangular in outline, much larger than lateral plate in size; apodemes simple, broad basally. Sternum 8 acuminate or rounded apically, with a weak ventral longitudinal carina; apex bare or with short weak hairs; lateral apodemes truncate or bidentate apically, set near base of sternum (Figs. 111-113).

Eumelissodes, subgenus nov.

Type species. Melissodes agilis Cresson, 1878.

This is the largest of the North American subgenera. It comprises approximately eighty species, many of which are polytopic. It is distributed from southern Canada, throughout the United States, south into the West Indies and Panamá.

Female. Small to large bees; integument generally black, often with rufescent legs, sterna and/or tegulae; terga with apical areas often translucent or transparent, usually black. *Clypeus flat to gently protuberant, never protruding beyond face by as much as half width of eye in profile;* eyes various, usually strongly converging towards mandibles, usually as wide as or wider than genal areas in profile, but occasionally much narrower; minimum length of first flagellar segment variable; *galeae smooth and shiny or variously sculptured,* usually with short straight hairs but rarely with hooked hairs, *less than twice and usually less than one and one half times as long as median clypeal length;* maxillary palpi 4-segmented, fourth shortest, second and third usually longest. Integument of head, thorax and terga variously sculptured; *tegulae with outer margins gently concave anteriorly* (Fig. 38); *metanotum usually shorter than dorsal face of propodeum medially, rarely longer; propodeum with dorsal face irregularly rugose, densely tessellate, rarely punctate apically and then usually punctures small and obscured by tessellation.*

Vestiture highly variable; thorax and tergum 2 without spatuloplumose hairs; terga 2 to 4 never with apical pubescent bands which are subequal to each other in width and of about the same width across each tergum; scopal hairs usually highly plumose, occasionally weakly so, never simple and unbranched.

Male. With characters of color and structure of female with the following additions: clypeus usually all pale, yellow to white, occasionally partially or wholly black; labrum all black to all white; mandibles with or without yellow basal spots; terga with apical margins often hyaline and transparent or translucent; *minimum*

length of first flagellar segment always shorter than half of maximum length of second segment and usually less than one third of second segment; tergum 7 always with short lateral spines similar to those of tergum 6, tergum 5 often with lateral spines; pygidial plate almost always notched laterally near apex, unless worn laterally.

Gonocoxite with dorsal carina not produced into a blunt process; *gonostylus various, usually somewhat capitate, half as long as gonocoxite or longer in dorsal view, slender, usually less than half as wide as greatest width of penis valve, usually with conspicuous short hairs near base and on outer surface;* penis valve large, lateral process usually well developed. *Sternum 7 with median plate large, flat, transparent, with abundant hairs ventrally; lateral plate usually piceous at least apically, with distinct apical or apicolateral process, usually much larger than one third and often more than one half of median plate in area;* apodemes variously shaped; membranous area between median and lateral plates not usually exceptionally large. Sternum 8 usually emarginate medially at apex, rounded laterally on either side of emargination, gently acuminate in apical half to one third, not sharply truncate, usually with abundant apical hairs; ventral carina usually weakly developed, short, usually apical, often bidentate or bilobed and transverse apically; lateral apodemes variously formed (Figs. 126-129).

Vestiture as in female with the following additions: tergum 5 with pubescent band usually similar to that of tergum 4; terga 6 and 7 usually with pale hairs, occasionally brown or black.

SPECIES ERRONEOUSLY REFERRED TO MELISSODES

In the course of preparing this paper, the author found 13 species described as belonging to the genus *Melissodes* (and considered as in that genus up to the present) but which obviously should be included in other genera. A list of these species, together with an indication of the correct taxonomic position of each, follows. A few species originally described as in the genus *Melissodes* were found to represent undescribed genera or to involve genera whose limits are undefined at present. These species will be dealt with in the future after additional study has clarified the status of the genera involved.

1. *Melissodes spissa* Cresson, 1872, Trans. Amer. Ent. Soc., vol. 4, p. 280, female [= *Xenoglossodes spissa* (Cresson), new combination].

2. *Melissodes suavis* Cresson, 1878, Proc. Acad. Nat. Sci. Philadelphia, vol. 30, p. 210, female [= *Tetralonia suavis* (Cresson), new combination].

3. *Melissodes pernigra* Cockerell, 1896, Ann. Mag. Nat. Hist., ser. 6, vol. 18, p. 289, male [= *Peponapis pernigra* (Cockerell), new combination].

4. *Melissodes pimella* Cockerell, 1906, Ann. Mag. Nat. Hist., ser. 7, vol. 17, p. 363, male [= *Xenoglossodes pimella* (Cockerell), new combination].

5. *Melissodes bishoppi* Cockerell, 1914, Canad. Ent., vol. 46, p. 414, male [= *Xenoglossodes bishoppi* (Cockerell), new combination].

6. *Melissodes atramentata* Cockerell, 1918, Trans. Amer. Ent. Soc., vol. 44, p. 30, female [= *Thygater atramentata* (Cockerell), new combination].

7. *Melissodes agilis* var. *parksi* Cockerell, 1935, Amer. Mus. Novitates, No. 766, p. 5, male [= *Xenoglossodes parksi* (Cockerell), new combination].

8. *Melissodes albomarginalis* Cockerell, 1949, Proc. U. S. Nat. Museum, vol. 98, p. 466, male [= *Xenoglossodes albomarginalis* (Cockerell), new combination].

9. *Melissodes crassidentata* Cockerell, 1949, Proc. U. S. Nat. Museum, vol. 98, p. 466, male [= *Peponapis crassidentata* (Cockerell), new combination].

10. *Melissodes flavifasciatus* Cockerell, 1949, Proc. U. S. Nat. Museum, vol. 98, p. 464, male [= *Xenoglossodes flavifasciatus* (Cockerell), new combination].

11. *Melissodes galerensis* Cockerell, 1949, Proc. U. S. Nat. Museum, vol. 98, p. 465, male [= *Xenoglossodes galerensis* (Cockerell), new combination].

12. *Melissodes spilognathus* Cockerell, 1949, Proc. U. S. Nat. Museum, vol. 98, p. 468, female [= *Diadasia spilognathus* (Cockerell), new combination].

13. *Melissodes tenuicincta* Cockerell, 1949, Proc. U. S. Nat. Museum, vol. 98, p. 464, female [= *Diadasia tenuicincta* (Cockerell), new combination].

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LITERATURE CITED

ASHMEAD, W. H.

1894. The habits of the aculeate hymenoptera. Psyche, vol. 7, pp. 1-25.

1899. Classification of the bees, or the superfamily Apoidea. Trans. Amer. Ent. Soc., vol. 26, pp. 49-100.

BANKS, N.

1902. Sleeping habits of certain hymenoptera. J. New York Ent. Soc., vol. 10, pp. 209-214.

BLANCHARD, C. E.

1849. *In* Cuvier, G. L. C. F. D., Le Règne Animal distribuè d'après son organisation. "Disciples" edition, Paris, Masson. Insectes, text vol. 2, 443 pp., atlas vol. 2, 202 plates.

Brimley, C. S.
1938. The insects of North Carolina. North Carolina Dept. of Agriculture, Division of Entomology, Raleigh, North Carolina. 560 pp.

Cockerell, T. D. A.
1905. Notes on some bees in the British Museum. Trans. Amer. Ent. Soc., vol. 31, pp. 309-364.
1905. Some bees collected by the Rev. G. Birkmann at Fedor, Texas. Canadian Ent., vol. 37, pp. 265-267.
1906. The North American bees of the family Anthophoridae. Trans. Amer. Ent. Soc., vol. 32, pp. 63-116.
1915. Habits of *Xenoglossa brevicornis* (Cresson) (Hym.). Ent. News, 26, p. 364.
1949. Bees from Central America, principally Honduras. Proc. U. S. National Museum, vol. 98, pp. 429-490.

Cresson, E. T.
1875. *In* Wheeler, G. M., Report of geological and geographical explorations and surveys west of the 100th meridian. Zoology. Vol. 5, pp. 509-1021, plates 16-45.
1879. Catalogue of North American Apidae. Trans. Amer. Ent. Soc., vol. 7, pp. 215-232.

Custer, C. P.
1928. On the mating habits of *Melissodes* Latr. Canad. Ent., vol. 60, pp. 28-31, 2 figs.

Dalla Torre, Karl Wilhelm von
1896. Catalogus Hymenopterorum; hucusque descriptorum systematicus et synonymicus. Leipzig., vol. 10, viii + 643 pp.

Dobzhansky, T.
1933. Geographical variation in lady-beetles. Amer. Nat., vol. 67, pp. 97-126.

Fernald, H. T.
1926. Climate and coloration in some wasps. Ann. Ent. Soc. Amer., vol. 19, pp. 88-92.

Folsom, J. W.
1922. Pollination of red clover by *Tetralonia* and *Melissodes*. Ann. Ent. Soc. Amer., vol. 15, pp. 181-184.

Harris, J. A., and Oscar M. Kuchs
1902. Observations on the pollination of *Solanum rostratum* Dunal and *Cassia chamaecrista* L. Kansas Univ. Sci. Bull., vol. 1, pp. 15-41, 1 plate, 6 tables.

Hart, Charles A., and Henry A. Gleason
1907. On the biology of the sand areas of Illinois. Bull. State Lab. Nat. Hist., vol. 7, pp. 137-272, 23 plates.

Hicks, C. H.
1926. Nesting habits of *Melissodes* Latr. Canad. Ent., vol. 50, pp. 28-31.

Hovanitz, W.
1941. Parallel ecogenotypical color variation in butterflies. Ecology, 1941, pp. 259-284.

LATREILLE, P. A.
1829. *In* Cuvier, Le Baron, Le règne animal distribuè d'après son organisation. ed. 3, Dèterville Libraire, Paris, vol. 5; xxiv + 556 pp.

LINSLEY, E. G.
1946. Insect pollinators of alfalfa in California. J. Econ. Ent., vol. 39, pp. 18-29, 6 tables.

LINSLEY, E. G., and R. W. MACSWAIN
1947. Factors influencing the effectiveness of insect pollinators of alfalfa in California. J. Econ. Ent., vol. 40, pp. 349-357, 7 tables.

LUTZ, F. E., and T. D. A. COCKERELL
1920. Notes on the distribution and bibliography of North American bees of the families Apidae, Meliponidae, Bombidae, Euglossidae, and Anthophoridae. Bull. Amer. Mus. Nat. Hist., vol. 42, pp. 491-641.

MICHENER, CHARLES D.
1944. Comparative external morphology, phylogeny, and a classification of the bees (Hymenoptera). Bull. Amer. Mus. Nat. Hist., vol. 82, pp. 151-326, figs. 1-246, diagrams 1-13.
1954. Bees of Panamá. Bull. Amer. Mus. Nat. Hist., vol. 104, pp. 1-176, figs. 1-155, tables 1-3.

MOURE, J. S.
1944. Abelhas de Monte Alegre (Est. S. Paulo) (Hym.-Apoidea). Papéis Avulsos do Dept. de Zoologia Secretaria da Agric.—S. Paulo—Brasil, vol. 6, pp. 103-125.

MUESEBECK, C. F. W., KARL V. KROMBEIN and H. K. TOWNES
1951. Hymenoptera of America north of Mexico. Synoptic catalog. U. S. Dept. Agric., Agric. Monographs No. 2, 1-1420 pp.

NETOLITSKY, F.
1931. Einige Regeln in der geographischen Verbreitung geflügelter Kaferrassen. Biol. Zentralbl., vol. 51, pp. 277-290.

RAU, PHIL
1934. Notes on the behavior of certain solitary and social bees. Trans. Acad. Sci. St. Louis, vol. 28, pp. 219-224.

ROBERTSON, CHARLES
1900. Some Illinois bees. Trans. Acad. Sci. St. Louis, vol. 10, pp. 47-55.
1905. Synopsis of Euceridae, Emphoridae and Anthophoridae. Trans. Amer. Ent. Soc., vol. 31, pp. 365-372.
1914. Origin of oligotropy of bees (Hym.). Ent. News, vol. 25, pp. 67-73.
1918. Some genera of bees (Hym.). Ent. News, vol. 29, pp. 91-92.
1926. Revised list of oligolectic bees. Ecology, vol. 7, pp. 378-380.
1928. Flowers and insects. Science Press Printing Co., Lancaster, Pennsylvania. 221 pp.

ROMAND, M. DE
1841. Notice sur divers insectes hyménoptères de la famille des mellifères. *In* Guérin, Mag. de Zool., ser. 2, ann. 3, pp. 1-6, plates 68-70.

SANDHOUSE, GRACE A.
1943. The type species of the genera and subgenera of bees. Proc. U. S. Nat. Mus., vol. 92, pp. 519-619.

SMITH, FREDERICK
1854. Catalogue of hymenopterous insects in the collection of the British Museum. Part II. Apidae. London, pp. 199-465, plates 7-12.

ZIMMERMANN, K.
1931. Studien über individuelle und geographische Variabilität paläarktischer *Polistes* und verwandter Vespiden. Zeitschr. Morph. Ökol., vol. 22, pp. 173-230.

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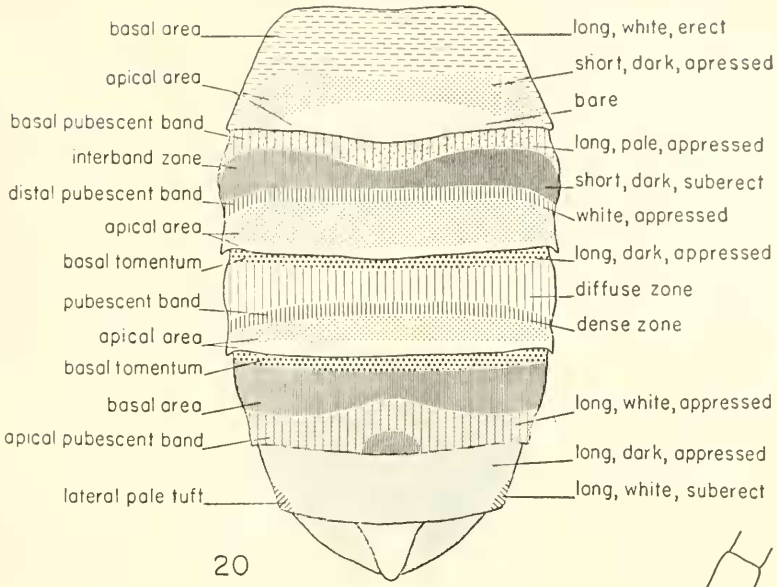
Names now known to be synonyms or homonyms are marked with asterisks.



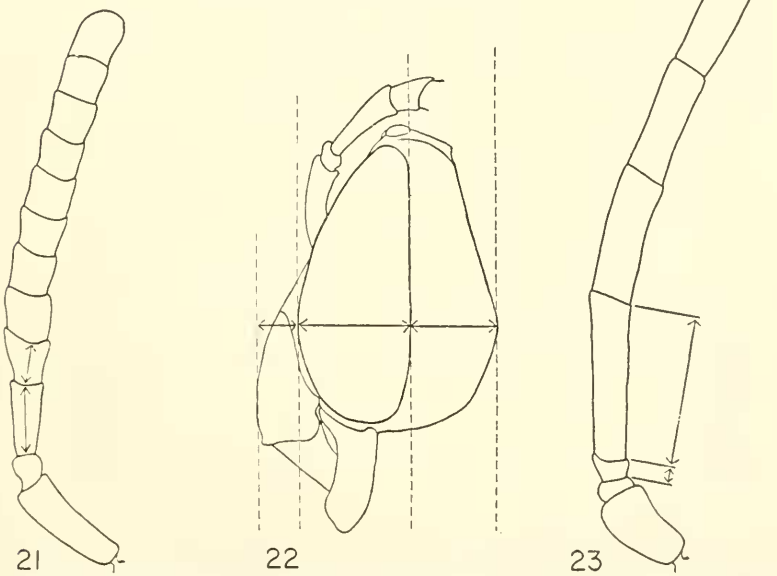
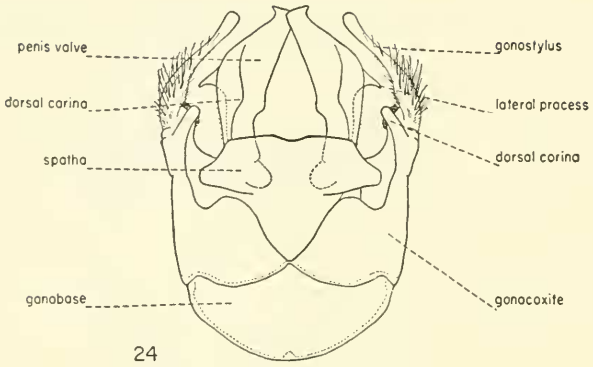


FIG. 20. Diagram of metasoma (approximately $\times 11$) of *M. communis* showing areas of vestiture. Regional terms are on the left and descriptive terms referring to the vestiture are on the right. Similar types of shading indicate similar types of pilosity.

FIGS 21-23. *M.* (*Eumelissodes*) *agilis*, approximately $\times 32$. Antenna of female (21) and antenna (in part) of male (23) to show method of measuring first two flagellar segments of each. Lateral view of female head (22) to show method of measuring clypeus, eye and genal area.



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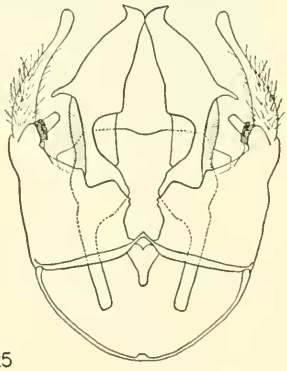

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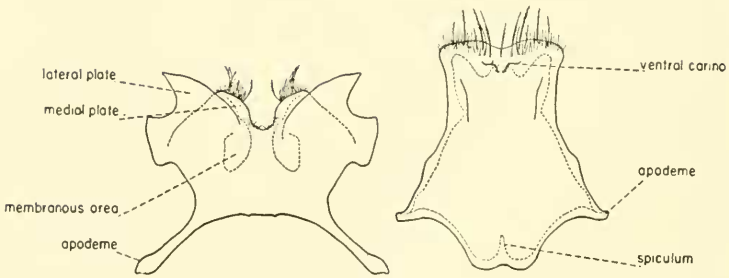

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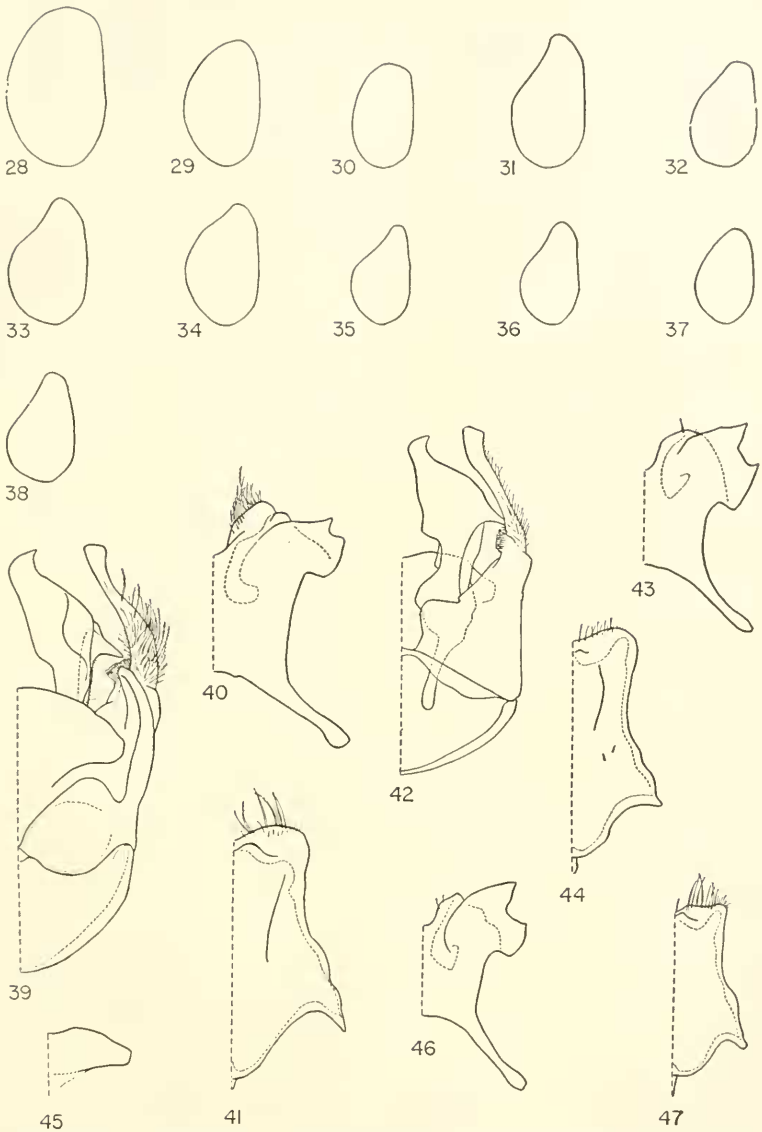
FIGS. 24-27. Genital capsule (dorsal and ventral views) and seventh and eighth male sterna, approximately × 45, of *M.* (*Epimelissodes*) *obliqua.*



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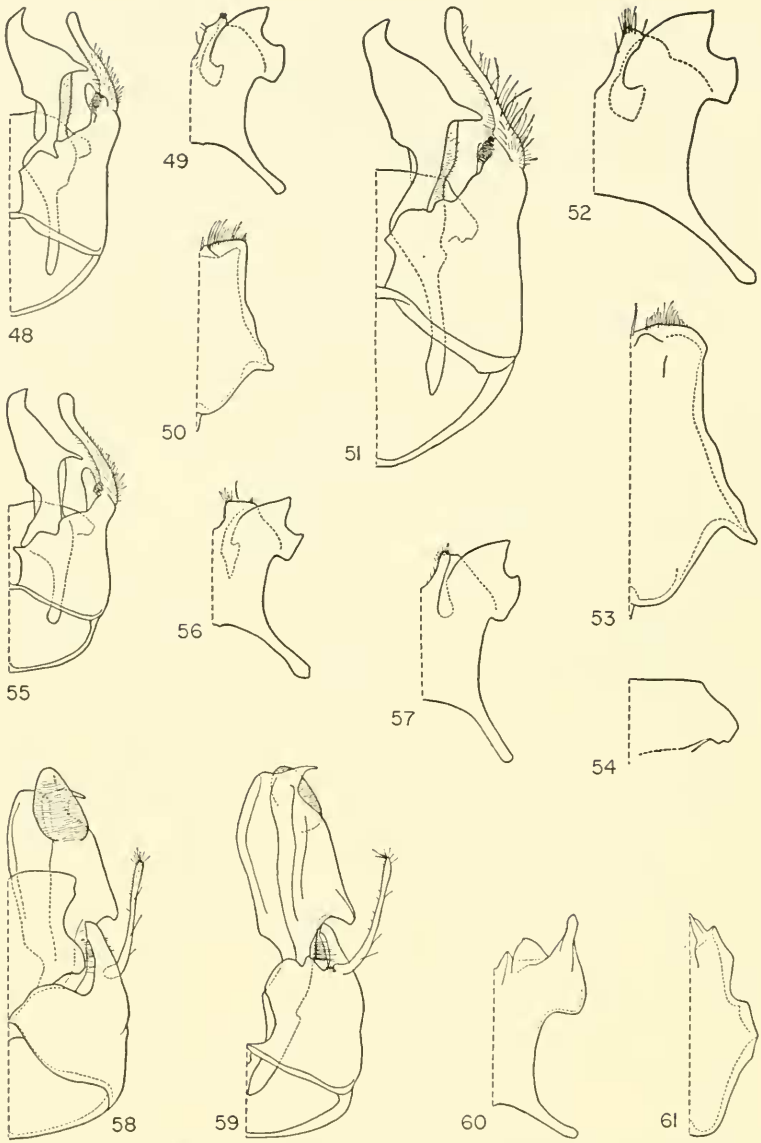

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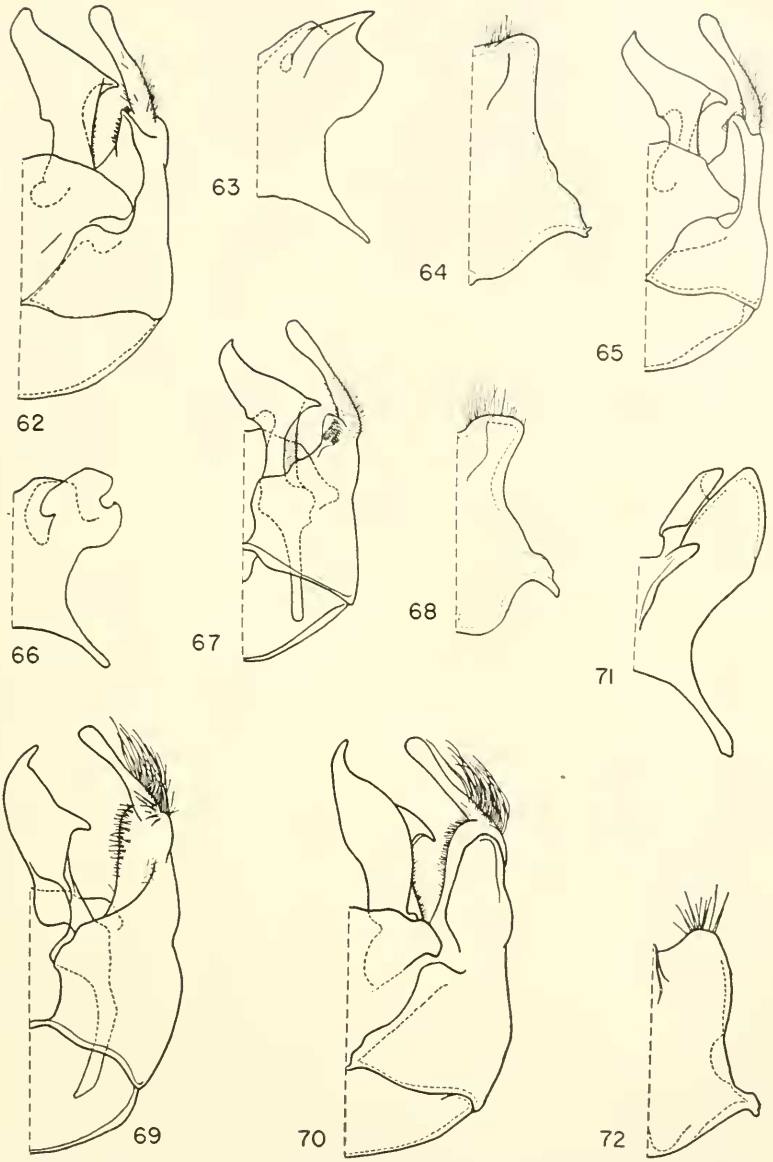

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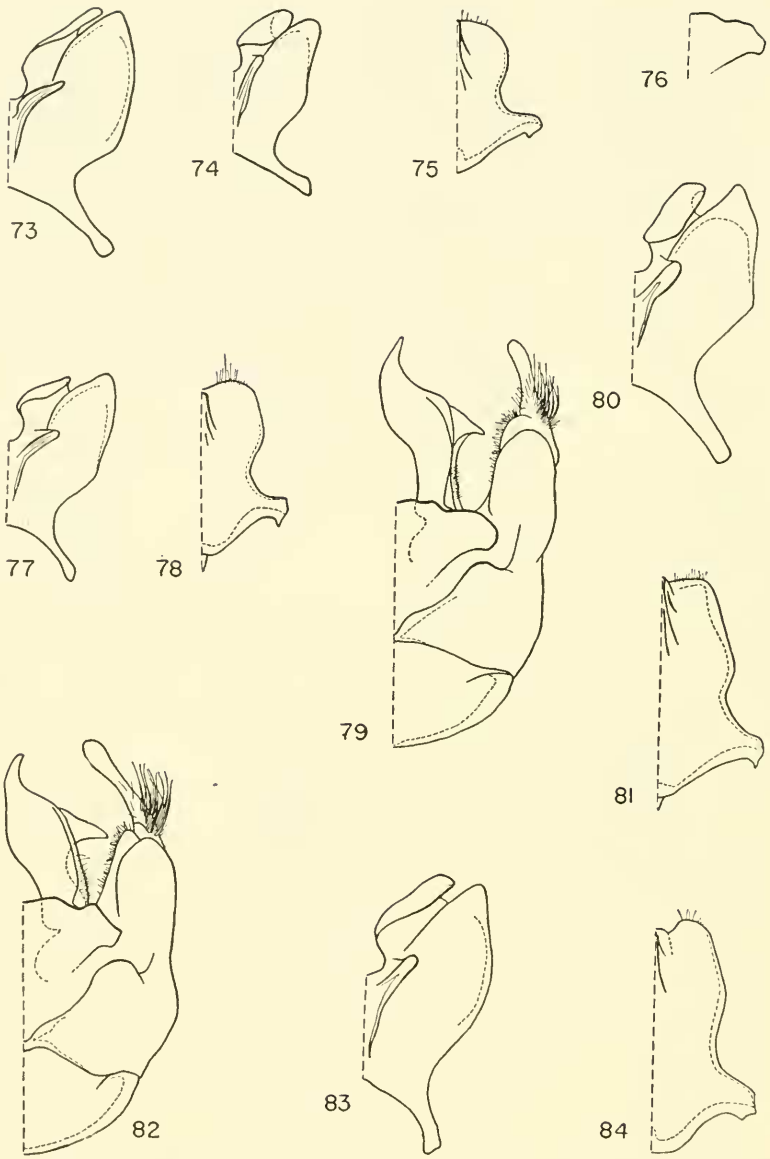

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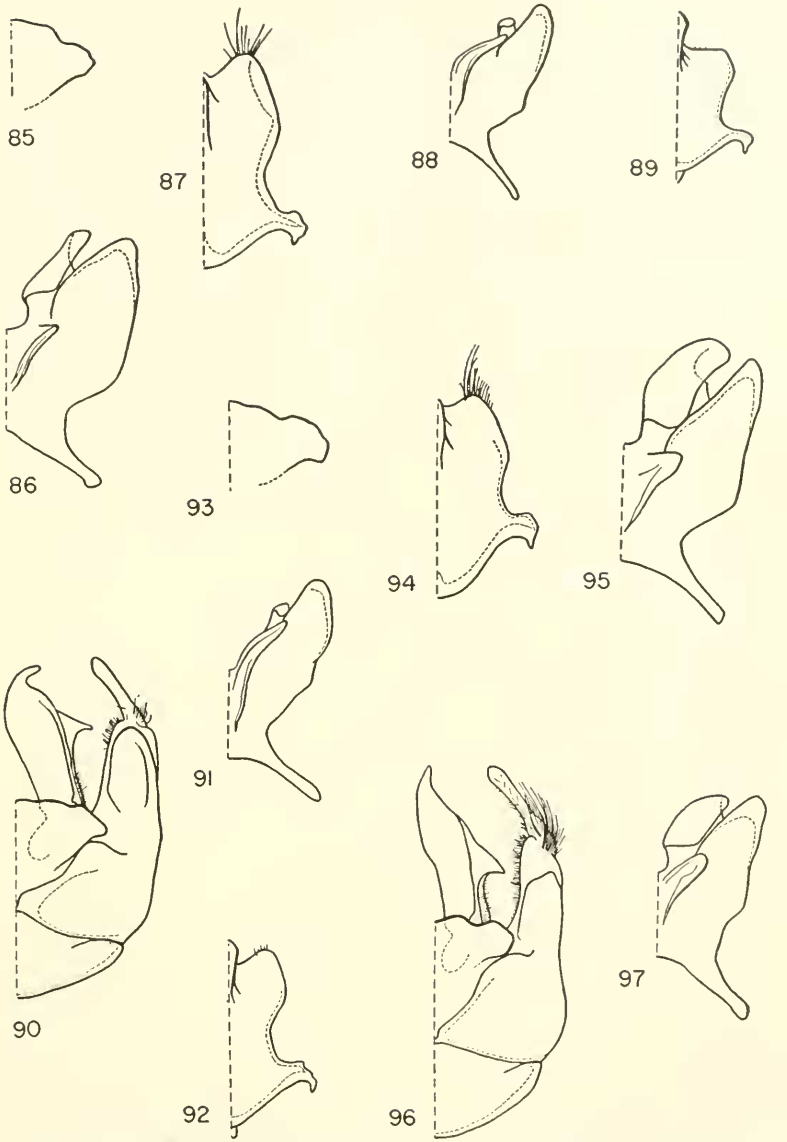

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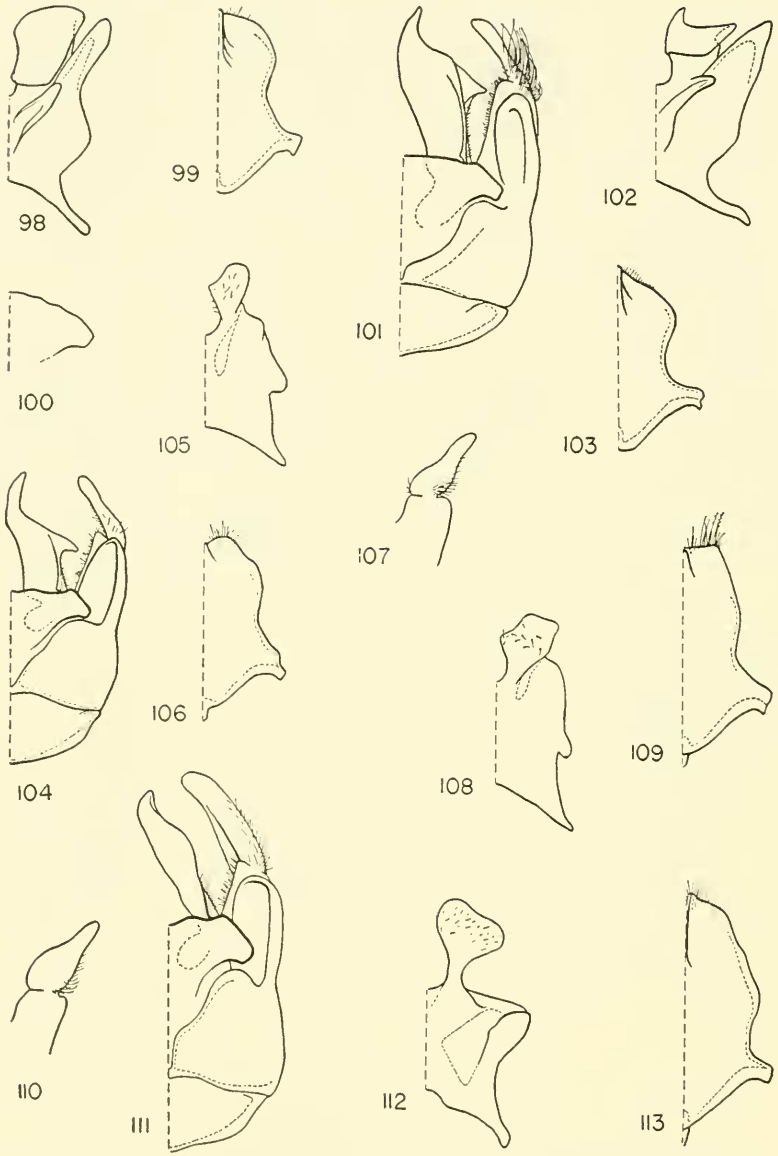

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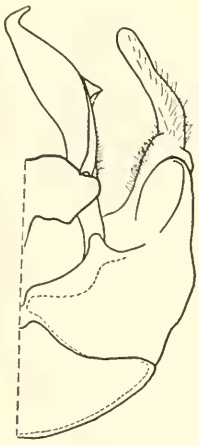

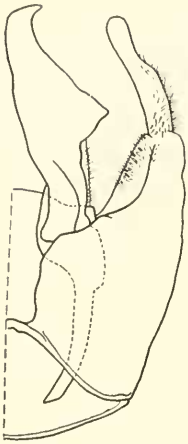

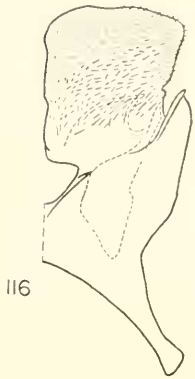

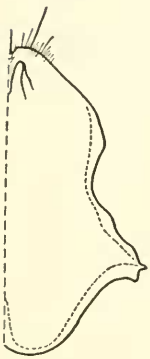

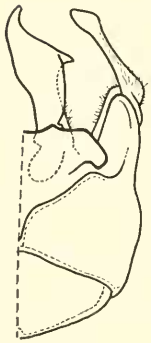

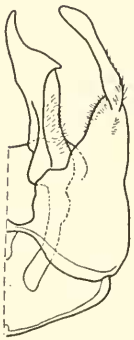

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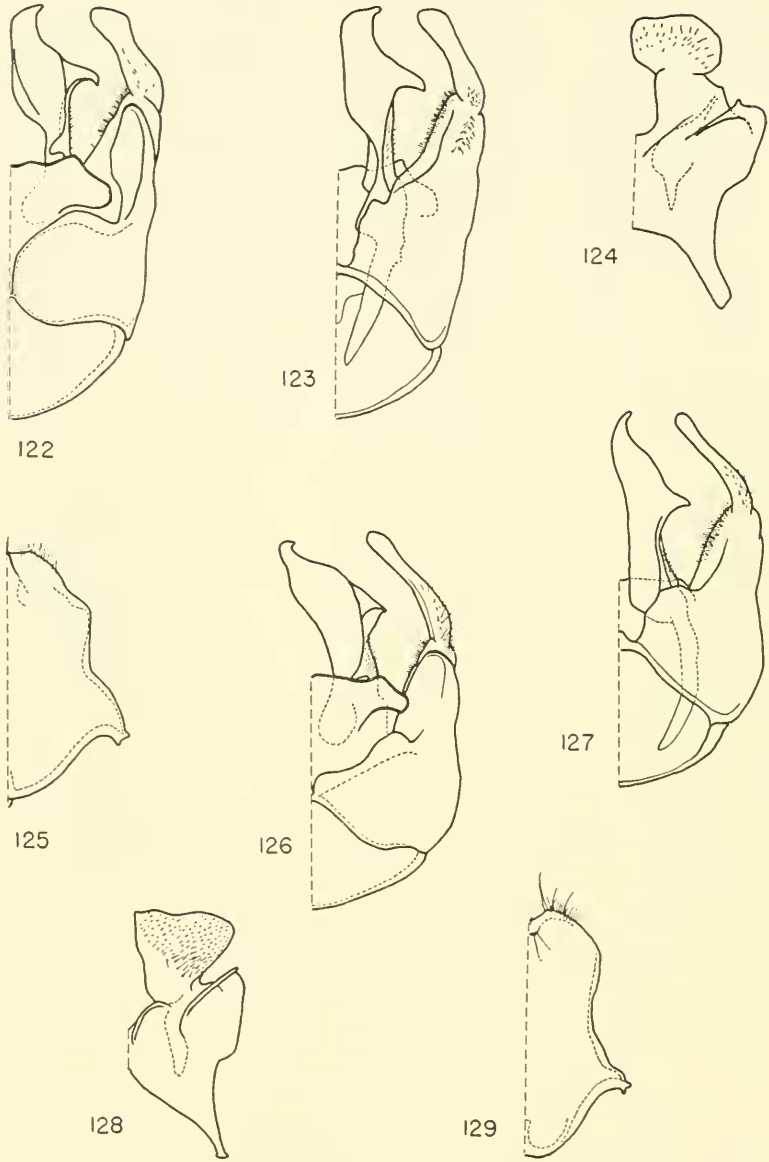

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